DEPARTMENT OF DEFENSE APPROPRIATIONS FOR 1987

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE

COMMITTEE ON APPROPRIATIONS

HOUSE OF REPRESENTATIVES

NINETY-NINTH CONGRESS

SECOND SESSION

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*Deceased April 10, 1986.

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1987

TUESDAY, MARCH 18, 1986.

RESEARCH, DEVELOPMENT, TEST, AND EVALUATION, ARMY

WITNESSES

HON. JAY R. SCULLEY, ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH, DEVELOPMENT AND ACQUISITION

LIEUTENANT GENERAL LOUIS C. WAGNER, UNITED STATES ARMY, DEPUTY CHIEF OF STAFF FOR RESEARCH, DEVELOPMENT AND ACQUISITION

INTRODUCTION

Mr. **CHAPPELL**. Our hearing this afternoon is closed pursuant to a motion made and passed in open session. We will receive testimony this afternoon on the RDT&E request of the Army.

The principal witnesses are the Honorable Jay R. Sculley and Lieutenant General Louis C. Wagner, Jr.

We have limited time this afternoon so we will put the statements of everybody in the record.

[CLERK'S NOTE.—The joint statement on Equipping the United States Army by Dr. J.R. Sculley and Lieutenant General Louis C. Wagner, USA, will be printed at the end of this hearing. See page 94.]

Mr. **CHAPPELL**. I understand you are prepared to give us, General, a short statement, a summary of your testimony following which we will have questions for you and the other witnesses.

SUMMARY STATEMENT OF GENERAL WAGNER

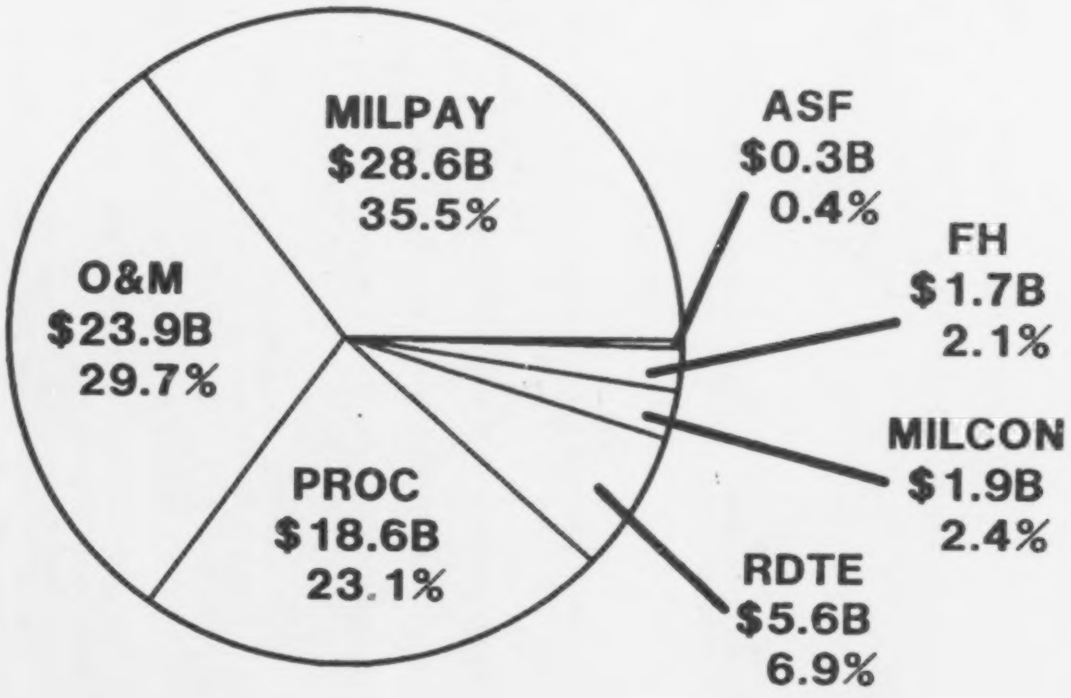
General **WAGNER**. Yes, sir. I would ask that you enter our total statement in the record.

Dr. Sculley should be here shortly.

I would like to spend five minutes to give you a background of how we put our program together and what our rationale was in selecting how we broke our dollars out.

[Slide follows:]

FY 87 PRESIDENTS BUDGET
US ARMY - BY PROGRAM



General **Wagner**. This is the total budget of the Army for the year. What we are going to discuss this afternoon is about 7 percent of it in RDT&E.

If you look at the total that we have in our investment accounts that we work with in research, development and acquisition, it comes to about 30 percent of the total $80 billion in the Army.

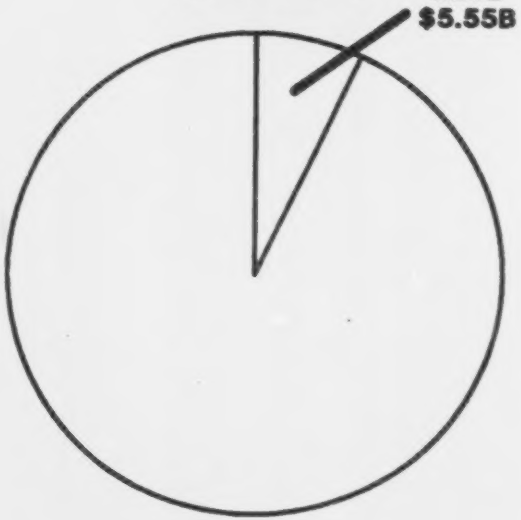
The RDT&E breakdown of the funds is among the various parts, as you see.

About half of it is in the tactical programs, the fighting systems that are so important to the Army.

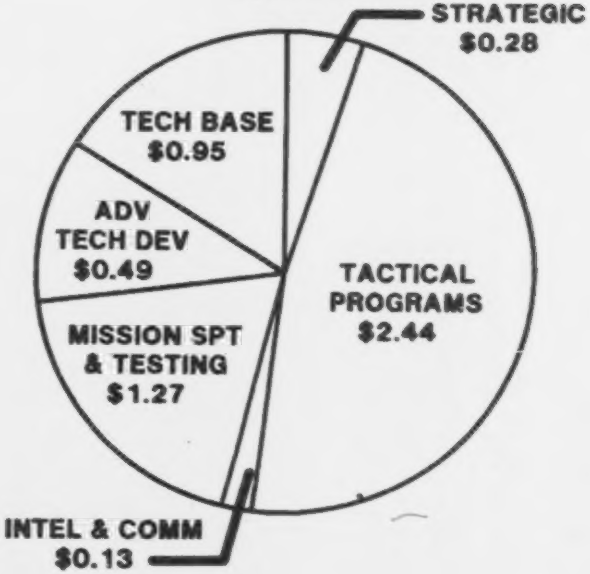
[Slide follows:]

THE FY87 RDTE BUDGET REQUEST

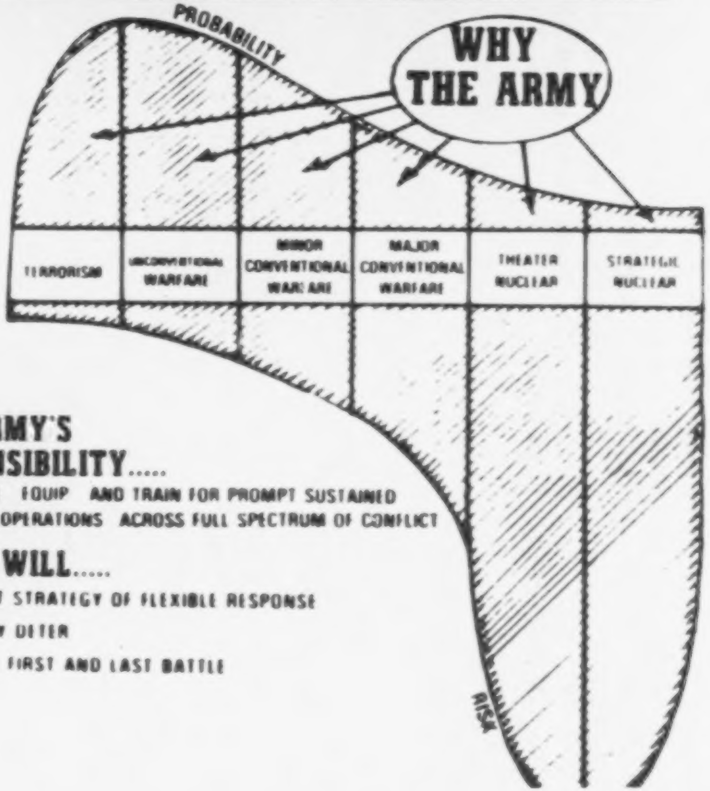
THE ARMY BUDGET
($80.6B)



THE RDTE BUDGET
($5.55B)



SPECTRUM OF CONFLICT


PROBABILITY
WHY THE ARMY
TERRORISM
UNCONVENTIONAL WARFARE
MINOR CONVENTIONAL WARFARE
MAJOR CONVENTIONAL WARFARE
THEATER NUCLEAR
STRATEGIC NUCLEAR
RISK

THE ARMY'S RESPONSIBILITY.....

- ORGANIZE EQUIP AND TRAIN FOR PROMPT SUSTAINED COMBAT OPERATIONS ACROSS FULL SPECTRUM OF CONFLICT

WHICH WILL.....

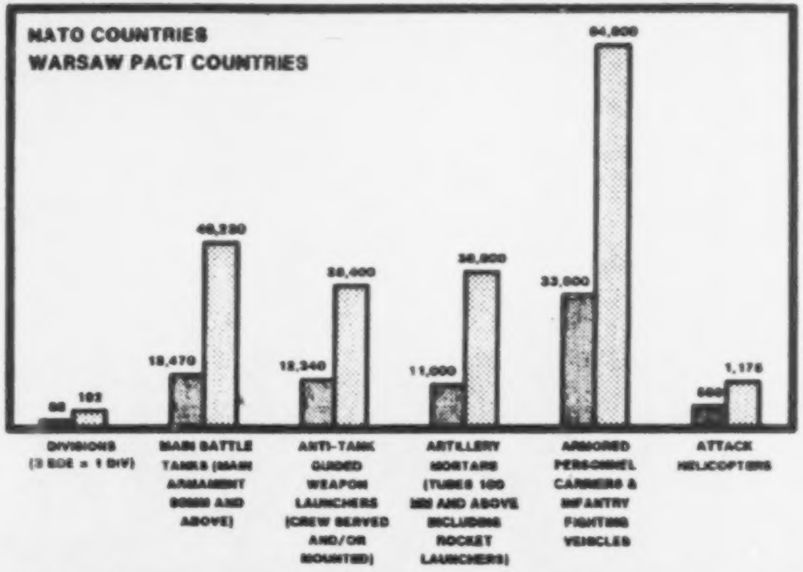
- SUPPORT STRATEGY OF FLEXIBLE RESPONSE
- CREDIBLY DETER
- WIN THE FIRST AND LAST BATTLE

SPECTRUM OF CONFLICT

General **Wagner**. In putting our program together, you will find that a majority of our dollars are spent to counter the threat on the high side, which is conventional warfare or a nuclear war in Central Europe. However, we do have dollars on the low side, the low intensity conflict or terrorism side, which is so essential in the contingency missions we have today.

[Slide follows:]

NATO-WARSAW PACT GROUND FORCE COMPARISON (IN PLACE IN EUROPE-1984)[1]



NOTES: WARSAW PACT DIVISIONS NORMALLY CONSIST OF FEWER PERSONNEL THAN MANY NATO DIVISIONS BUT CONTAIN MORE TANKS AND ARTILLERY. THEREBY OBTAINING SIMILAR COMBAT POWER.

WARSAW PACT TOTALS EXCLUDE THE 17 STRATEGIC RESERVE DIVISIONS IN THE MOSCOW, VOLGA AND URAL MILITARY DISTRICTS.

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[1] EXCLUDES FRANCE AND SPAIN.

THREAT

General **Wagner**. The principal reason we have to put dollars into research and development and in acquisition is because in every major fighting system, tanks, anti-tank weapons, artillery, armor fighting vehicles and attack helicopters, we are outnumbered 2 to 3½ or 4 to 1. We have been that way for years.

Mr. **Chappell**. Is that an acceptable posture?

General **Wagner**. We don't think it is. I will show you some improvements we have made. This doesn't include France.

If you add France in, you get about 1,500 tanks which don't make an appreciable difference and 5,600 fighting vehicles, again not an appreciable difference in the overall balance.

[Slide follows:]

PRODUCTION OF GROUND FORCES MATERIEL USSR/NSWP AND NATO*

EQUIPMENT TYPE	1984 USSR	NSWP	1984 NATO
TANKS	3,200	450	1,760
OTHER ARMORED FIGHTING VEHICLES	3,800	1,200	2,230
TOWED FIELD ARTILLERY	1,600	250	425
SELF-PROPELLED FIELD ARTILLERY	1.000	300	240
MULTIPLE ROCKET LAUNCHERS	600	100	80
SELF-PROPELLED AA ARTILLERY	50	0	40
TOWED AA SRTILLERY	-	225	50

*REVISED TO REFLECT CURRENT TOTAL PRODUCTION INFORMATION.

INCLUDES UNITED STATES: EXCLUDES FRANCE AND SPAIN.

NSWP IS NON SOVIET WARSAW PACT.

General **Wagner**. What worries us is the modernization rate of the Soviet and their Warsaw Pact allies and then compare it with NATO. Again you can see they are outproducing us at 3 or 4 to 1, too, in these principal items.

The key to this is that these Warsaw Pact items are good pieces of equipment, on a technological level almost as good as what we are putting in the field today so we have to make sure we keep up the momentum and keep ahead of them if we can.

Mr. **Chappell**. The right column is what?

General **Wagner**. This is a total of what the NATO nations produced last year.

For example, in fighting vehicles, they produced a total of 1,760, tanks, other armored fighting vehicles, 2,230.

Mr. **Chappell**. How many did we produce?

General **Wagner**. We produced 820 of those tanks, so about half as many as the total NATO forces did.

Mr. **Chappell**. Are you saying that this is our NATO production——

General **Wagner**. Yes, sir.

Mr. **Chappell**. Is the left line the USSR production?

General **Wagner**. This is the USSR and this is the non-Soviet Warsaw Pact. So you add these two together and you get what would be facing us in Central Europe, 3,650 tanks produced last year. Some were produced in Poland, some in Czechoslovakia. They are Soviet-designed tanks, but they produce them there.

Mr. **Chappell**. Are they producing 3,650 against our total NATO production of 1,760?

General **Wagner**. That is right.

Mr. **Chappell**. And we are talking about tanks?

General **Wagner**. Yes, sir.

Mr. **Chappell**. In other armored fighting vehicles, they are producing 4,800 per year. We are producing a total of 2,230.

General **Wagner**. Yes, sir.

Mr. **Chappell**. And towed field artillery, they are producing 1,850 and we are producing 425?

General **Wagner**. Yes, sir.

Mr. **Chappell**. Do you have a chart that shows what the total numbers are now?

General **Wagner**. No, sir. I don't have the total numbers. If you count all their tanks, they have 40,000 to 45,000 in that part of Central Europe. We have about 15,000, about 3 to 1. The ratio hasn't changed appreciably in total tanks.

Mr. **Chappell**. Dr. Sculley, good to have you with us.

Mr. **Sculley**. I apologize for being late.

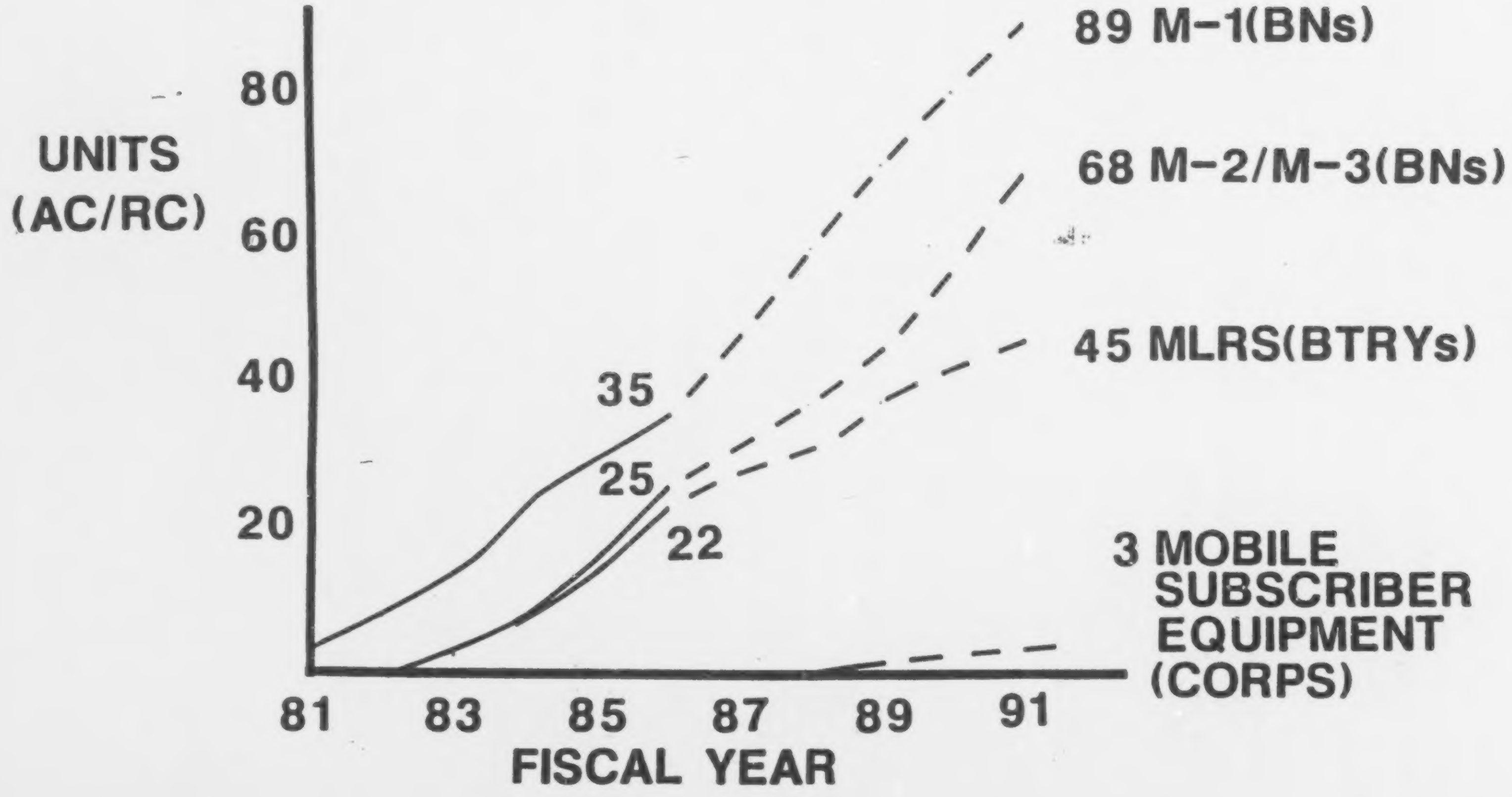
Mr. **Chappell**. That is all right. We are getting good testimony anyway, Doctor. That is what the General said anyway.

General **Wagner**. They told me to go ahead.

Mr. **Sculley**. I think we are on the same wave length, sir.

[Slide follows:]

UNIT MODERNIZATION



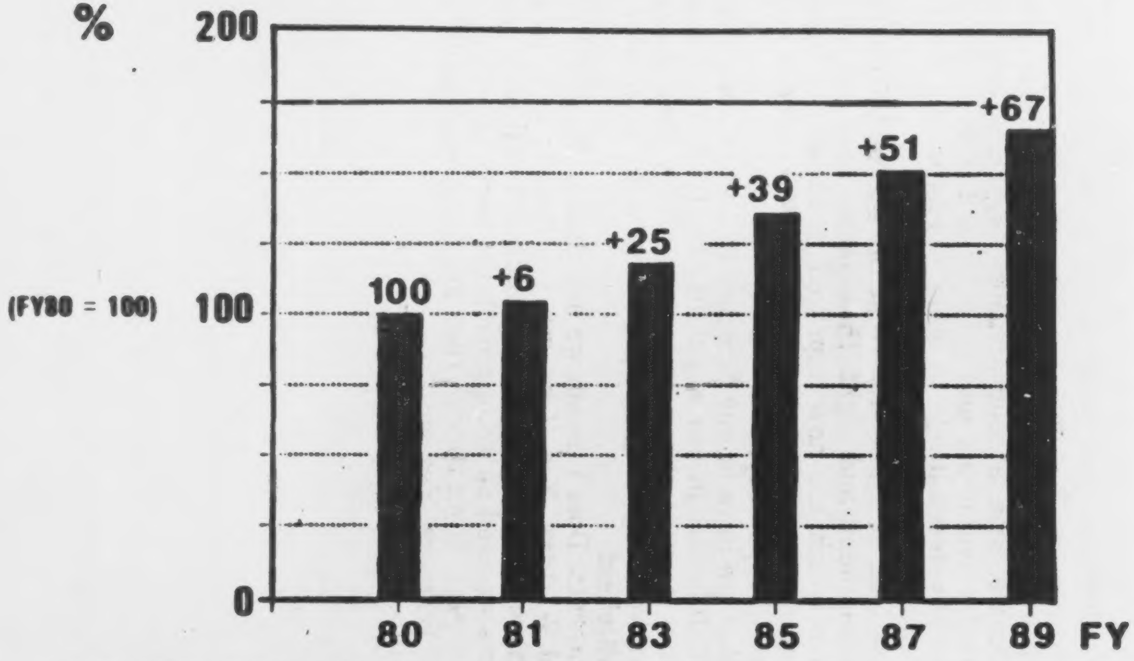
UNIT MODERNIZATION

General **Wagner**. However, it is not all bad and one key reason it is not all bad is because of the support we have had here during the seventies in RDT&E and what we are getting in acquisition now. We are fielding a lot of equipment to modernize our forces today.

At the end of fiscal year 1986, we will have fielded 35 battalions of M1 tanks. We will have fielded, for example, 34 companies of UH-60 Blackhawk helicopters. A big fire power difference on the battlefield today is 21 batteries of Multiple Launch Rocket Systems that we are going to get.

[Slide follows:]

TOTAL ARMY
MILITARY CAPABILITY IMPROVEMENTS



MAJOR COMBAT UNITS (DIVISIONS, SEPARATE BRIGADES, ARMORED CAVALRY REGIMENTS)

TOTAL ARMY MILITARY CAPABILITY

General **Wagner**. When we war game what has happened between our divisions and those Soviet divisions that we would be fighting starting with where we stood in 1980 and where we are today with modernized equipment, we found we have improved.

For example, look at our divisions, separate brigades and armored cavalry regiments and take 80 as the start point, and use that as a 100 percent level—in other words, normalize our capability there and say that it is our 100.

When we look at where we are at the end of 1985 with the modernized equipment and fight those same war games against a Soviet force which has now improved its capability because it has new equipment, we find we have about a 39 percent improvement in our overall capability.

With what we have in our program in 1987, we will have about a 30 percent increase in our capability by 1989. That doesn't mean that we are in great shape, but it does show that the modernized equipment we are getting today gives us a much greater capability on the battlefield.

Mr. **Chappell**. Does it mean we are closing the gap?

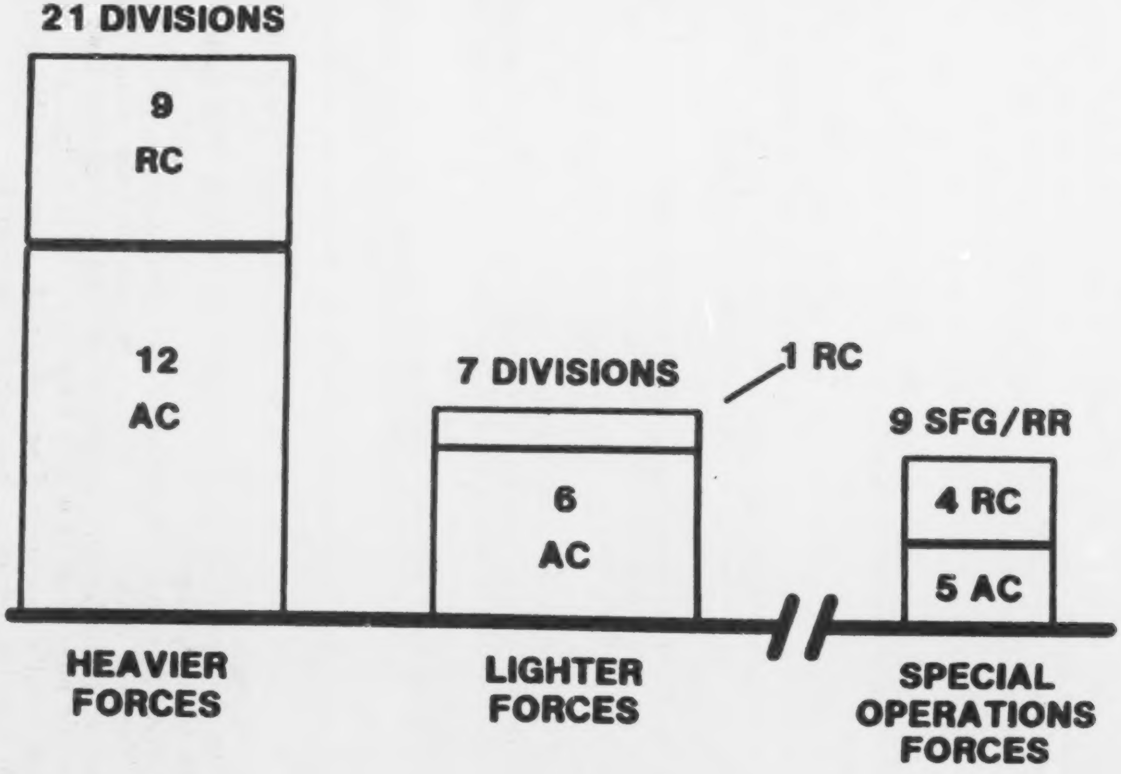
General **Wagner**. Yes, if we can continue to buy the equipment that we have in our procurement budget. I will show you some of the systems we need as we approach the early nineties.

Mr. **Chappell**. Even though they are outproducing us?

General **Wagner**. Yes, sir.

[Slide follows:]

COMPOSITION OF THE TOTAL ARMY



COMPOSITION OF THE TOTAL ARMY

General **Wagner**. This is that force that we equip. You will see that it is made up of our reserve components, nine heavy divisions, and our active components with 12 heavy divisions. A majority of our divisions are still on the heavy side because these are the divisions that we would need to fight the war in Central Europe.

However, we have many contingency missions we have to be prepared to fight and that is the reason we have lighter divisions so they can move to an area rapidly to put down brushfire wars.

We are also designing them so they have a capability to fight on the heavy side in Central Europe by augmenting them with additional artillery, and things of that nature.

TRAINING

Mr. **Chappell**. Let me ask you one question that always concerns me. There are some that fuss about us spending as much on maneuvers and training exercises and so forth. I am a strong believer that that is where the money can be very effectively spent.

Are we doing enough in training by divisions, training by all the other segments, enough to really keep our people competent, capable, the reserve units as well as your active units?

General **Wagner**. It is very difficult to maneuver a division. We do that periodically, but even then you can't move the entire division at one time. However, we have now at the National Training Center at Fort Irwin, what is the best training the Army has ever had.

It is the only place where brigade-size units go up against a Warsaw Pact-like enemy. The opposing forces have equipment that resembles the Warsaw Pact. They use Warsaw Pact tactics and also they outnumber the friendlies, so it is that kind of a war they would actually fight.

It is realistic. It is highly instrumented; when you finish a battle, you know immediately whether you have won or lost.

It is instrumented with our laser devices so we know whether they are killed or not.

We are finding tremendous improvements in the units after they go through that exercise.

In this year's budget, we plan on sending 28 rotations through the training center.

Mr. **Chappell**. Who wins in these exercises?

General **Wagner**. Sometimes we win and sometimes they win. In some of the recent exercises—in fact one of the best ones that people have seen in a long time that ended in late February, which was a fully modernized brigade of M1 tanks and M2 and M3 Bradley fighting vehicles, they won in this exercise.

They won because of that equipment and they also won because it was a very well trained and led unit. You can have the best equipment in the world, but if you don't go through training like that and don't have the leaders with imagination and the ability to think quickly, you are not going to win. That is why we think it is so important to continue that.

Mr. CHAPPELL. Are we conducting our training on a realistic basis? Are we putting these brigades against two or three? Are we really matching it up like we think the situation will be?

General WAGNER. We are. It is the only training I have ever seen like that. We lose probably more frequently than we win. The only units I have seen win frequently have been those that have had the new modern equipment that gives them an advantage on the battlefield so that the commander can use them effectively.

When I was a commander at Fort Knox, we had a separate armored brigade there. I watched them go out there two times. They won periodically, but they lost more than they won.

It is an excellent story, however, because they are learning what their mistakes are, and every time you watch them they get better.

Mr. CHAPPELL. They are going to start winning, you are saying?

General WAGNER. Yes, sir.

When you take a unit out there that hasn't had a chance to do that before, they have a difficult time the first few days because they go for miles in these exercises. It is not a small training area. They can march many miles. They can attack for 10 or 15 miles. They go through very difficult terrain to do this. They have to learn to use the terrain. You don't learn that unless you get soldiers on the ground.

When they go home, they take with them a complete training package saying what they did right and what they did wrong. It tells them why they won or lost. We are improving the take-home packages with tapes to run through computers and see what they did wrong in the battles.

Mr. CHAPPELL. Do you let them back through after they have done the training and it is hot in their minds—do you put them back through it, and do they win?

General WAGNER. In many cases, they do and in a few they don't. They are there two weeks and during that two-week period, they run many repetitions. You can see a significant difference at the end of the two weeks. There have been units that have been there more than once. They do much better when they come back because they have practiced the things at the home station and they improve. Even when they change commanders, they improve because they have the after action reports to work with.

Mr. CHAPPELL. The Soviets have a similar activity, I assume?

General WAGNER. They have no problem with space, but they do not shot as much, for example, with their tank crews a year as we do. We believe that practice makes perfect in training tank crews. We have reduced the number of rounds because we have some very good simulators today, but we still shoot more rounds more frequently than the Soviets do and we think that is a great advantage we have over them.

We shoot about the same as the Germans and more than the French and the Italians.

Mr. CHAPPELL. How long since we have won a competition with the tanks in the shootoff in Germany?

General WAGNER. In the Canadian Cup, if the total scores are summed for units, the M1 tank unit would have come out on top.

Mr. CHAPPELL. How did it come out?

General **WAGNER**. It came out with an American crew in an Abrams tank on top. In the platoon competition we came in second.

Mr. **CHAPPELL**. This training ammunition that we have provided——

General **WAGNER**. I will provide the specific scores for the record.

Mr. **CHAPPELL**. Do that because I had intended to go watch that shootoff and couldn't make it. I have been concerned that we don't seem to stand up to the Germans and others in the shootoff. I want to know whether it is training or ammunition or what.

General **WAGNER**. That is a good shootoff, but I would never say that that training bears any real relationship as to how you are going to fight as compared to our National Training Center.

[The information follows:]

The 1985 Canadian Army Trophy competition was conducted at Bergen-Hohne NATO Training Area in West Germany. This competition is affected by many factors ranging from weather to crew proficiency. One difference in performance however, is evident. Those units with modern tanks out shot the older tanks. Platoons using the Abrams and Leopard II tanks averaged 20,739 points while units with less modern tanks averaged 16,901 points or 3,838 fewer points. The actual results are shown below:

Platoon finishing order			Team finishing order		
Unit	Tank	Points	Unit	Tank	Points
FRG (244PZ)	Leo II	22,037	US (3-64)	M1	43,255
US (3-64)	M1	21,934	FRG (244PZ)	Leo II	42,597
NETH	Leo II	21,364	NETH	Leo II	41,278
US (3-64)	M1	21,321	US (2-66)	M1	40,640
FRG (244PZ)	Leo II	20,560	FRG (24PZ)	Leo II	39,622
US (2-66)	M1	20,341	FRG	Leo IA1	38,703
US (2-66)	M1	20,305	BEL	Leo I	35,816
FRG (24PZ)	Leo II	20,011	BRIT	Cief	33,393
NETH	Leo II	19,914	US	M60A3	32,627
FRG	Leo IA1	19,746	CAN	Leo I	28,474
FRG (24PZ)	Leo II	19,611			
FRG	Leo IA1	18,957			
BEL	Leo I	18,152			
BRIT	Chief	17,829			
US (3-32)	M60A	17,718			
BEL	Leo I	17,664			
BRIT	Chief	15,564			
CAN	Leo I	15,175			
US (3-32)	M60A3	14,909			
CAN	Leo I	13,299			

Mr. **CHAPPELL**. I understand it only has to do with how proficient they are and how accurate they can be in their fighting.

General **WAGNER**. I am a tanker and have watched that many times and in that particular exercise it is not the way you fight battles, unfortunately.

Mr. **CHAPPELL**. But it takes accuracy to win battles, too, so you are testing our ability to fire against others.

General **WAGNER**. There is a lot of timing in that and if you go out and practice on that particular range and anticipate targets coming up, you can shoot faster.

I mean, there are tricks to that which you wouldn't have in war. To be honest, you shoot when you see the target coming up and you are going to get a hit because you are going to hit at the base of it. If you want to win that competition, you teach those tricks to the gunner. You wouldn't do that in wartime, so while it is a great competition, I say that the money is ten times better spent at the National Training Center than all the money spent in the Canadian Cup Competition.

Mr. **Chappell.** I am not taking away from the training centers because I am a great believer in that.

AIRLAND BATTLE

General **Wagner.** When we then look at our acquisition and at our R&D, we have to look at the total battlefield and see where our deficiencies are. We fight a battle, and I am not teaching tactics today, but we call it AirLand battle because we never fight alone in the Army, it is the Air Force, the Army, the Marines in some cases the Navy. We are generally fighting with an ally to win the battle.

The corps commander orchestrates the battle and he looks 150 kilometers beyond the front line. He has to be responsible for his rear and he needs the weapon systems to effect the battle.

A lot of people would say it would be great if you could win the battle at 150 kilometers beyond the front line. We don't know how to do that today. The only capability we have of striking there is the Air Force today.

However, if we did have a capability to strike the enemy there and upset his timetables, it could be very helpful to us in fighting the key battle at the front line. That is why there is something in the budget called the Army tactical missile system which will give the corps commander a capability to strike out there.

You will find a joint tactical fusion program to allow the corps commander to take the information of the enemy and fuse it quickly enough to make a decision to fire. The JSTARS is a radar system we are developing with the Air Force so we can look out there and see what the enemy is doing.

Mr. **Chappell.** How are we coming along with that?

General **Wagner.** Good. We have the ground station where the data will come to us and we will use it. The Air Force is developing the radar. Initially it will be on the C–18 and there is another piece of that program to put it on the aircraft that would be more stealthy and could fly closer to the front lines.

There are two pieces to that program that are working now.

Mr. **Chappell.** You have two Boeing 747s in the program now and you are asking for a third. Is that right?

General **Wagner.** There are two C–17's which is a 707. We would like to have a third one because we think it would be very helpful to us in getting an early capability to Europe for testing.

Mr. **Chappell.** Is that in the budget?

General **Wagner.** That is not approved by the Congress. That was turned down last year.

Mr. **Chappell.** Do you have it in the budget again?

General **Wagner.** No, sir. That is one we are still working on.

Mr. **Chappell.** Have you identified the new platform?

General **Wagner.** The new platform is in a special access program, sir.

Mr. **Chappell.** OK. Go ahead.

R&D PROGRAMS

General **Wagner**. At this front line we have a number of program in R&D to increase our capability there. We are looking at advanced anti-tank weapon systems. That is all I will say now because we will discuss that later. We are looking at air defense and the LHX helicopter. We are looking in the future at a new family of wheeled vehicles to give us the support that we need in the rear area.

All of this we do in R&D wouldn't be very effective if we didn't have a strong technology base. The key to our technology base are labs, 20 on the materiel side, 9 medical, 4 in the engineers, and 1 on the personnel side. The majority of the work, however, is not done in those labs. The majority is done on contract to outside industry, about 65 percent of that you find in our technology base.

However, these are the people that have to then be the smart shoppers and know where to spend that money in industry to gain the maximum amount from it.

Where we do a lot of work in-house is in our medical labs because we can't get some of the work they have to do in looking at diseases that are not endemic to the United States but to the rest of the world because it doesn't interest U.S. industry. It is not a high payoff. So we do it in-house.

Mr. **Chappell**. When you told us where we were going to fight the air-land battle in the year 2000, you talked about changing emphasis. You said rather than take the technology and try to adapt that technology to a mission, it is better to define the mission and then try to find the technology that better does the mission.

Am I saying that correctly?

General **Wagner**. That is exactly right, sir.

Mr. **Chappell**. Are we doing well in taking that approach?

General **Wanger**. We think we are. That is called the concept based requirement system. The Training and Doctrine Command of the Army which develops the doctrine on how we are going to fight comes up with that doctrine for the year 2000 and beyond.

They then work with the development side which is the Army Materiel Command, to determine what is the piece of equipment that will give us great effectiveness on that battlefield.

I have worked in both of those organizations in times past and I can tell you that at no time in the last 20 years have those two groups worked closer together to make sure that we are developing the right items for the soldier to fight that battle.

In fact, I just went to a meeting in Atlanta last week with leaders from industry headed up by the Army Materiel Command.

Three of the major speakers there were the Commander of TRADOC, the Commander of FORSCOM, the Army Forces Command and the Combat Developer from TRADOC, because they must tell the user what they need.

On the other hand, they are not smart enough to do that if the developer doesn't tell them what is available in technology that they may be able to come up with; so it is really a back-and-forth dialogue between them.

The bottom line you can't do either one in isolation.

This chart shows you where we could take any item of equipment although this looks like a tank. It wouldn't matter what it was because we have to focus our technology base to make sure that we are developing every item that we are going to need in the future so the technology is here where we get ready to go to full scale development of a particular item.

For example, if we thought about the tank of the future, we have got to look at what kind of sensors do we need on it. We have to look at the gun system, how do we lighten it up.

We can never afford in my view in the future to have a 65-ton tank because with what we can do in composites and weapons today, we think we can make that a lighter tank and yet much more effective.

We have to think about battlefield sustainment, therefore we are looking at power packs and transmissions for the future so that when the middle of the nineties comes along and we look at replacing some of these systems, we have the power pack tha will be efficient and can do the job for us.

We are working very hard to tie our technology base into wheat we need in the future.

Mr. CHAPPELL. Did your transverse engine concept have any real advantage for you?

TANK TEST BED

General WAGNER. The transverse engine is something we are still looking at. In fact, if we were going to look at the transverse engines, one of the places we might look at is in this test bed.

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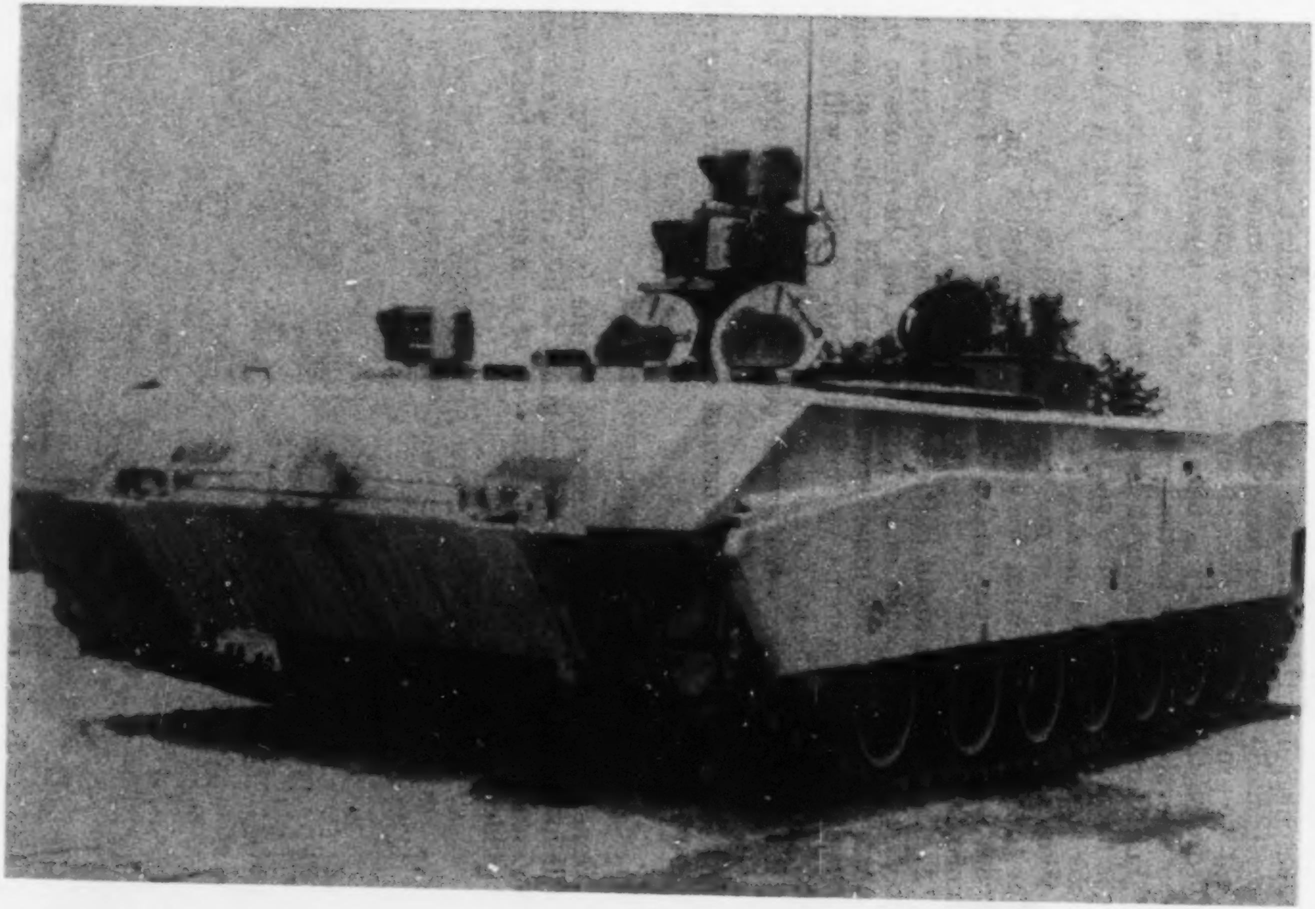

General **Wagner**. This is a test bed that we have in our technology base not to design the tank, but to look at such things as what should the size of the crew be.

In fact, that is what they used this one for. And then what kind of sensors can you put on it.

Finally, you might want to look at putting the transverse engine in that one.

[Slide follows:]

LIGHT WEIGHT TOWED HOWITZER
"COMPOSITE MATERIALS"

LIGHTWEIGHT HOWITZER

General **Wagner**. This is another test bed we have going. Our towed Howitzer today weighs 16,000 pounds. We are designing in the technical base (not necessarily that we are going to replace that Howitzer), but we want to see what is available if we could lighten it up. We believe we can build that same Howitzer with the same capability at fewer pounds, perhaps 9,000 pounds.

Mr. **Chappell**. Don't the Soviets use a lot of motorized artillery?

General **Wagner**. Yes, sir.

In fact, if you had asked me five years ago, I would have said they had more towed than they do self-propelled. Today they are transitioning almost all their divisions to self-propelled.

Mr. **Chappell**. Isn't that a tremendous advantage?

General **Wagner**. Yes, sir, and we have self-propelled ourselves in all our heavy divisions.

Mr. **Chappell**. Are we moving to bring in a higher percentage of motorized artillery?

General **Wagner**. We were moving too slow on improving that artillery. We have an improvement program going this year and we are looking at artillery of the future around 2000. We have the Howitzer improvement program to give improved autonomous capability and reliability and improved survivability on the battlefield.

Mr. **Chappell**. That is the HIP program?

General **Wagner**. Yes, sir.

MEDICAL PROGRAMS

Continuing now with our medical development programs, this is just a simple sample of something we are doing. It doesn't smell very good, but what this is is a pad that would go under a piece of tape, sir. You can put that on an open wound and it is impregnated with antibiotics, which it releases it over a period of three to six days.

The biggest problem we have with soldiers in combat is infection. You can stop it if you get the antibiotics to it in a hurry so this is something that the buddy or soldier himself can put on wounds and we think keep down infection a lot. That is a blown-away jaw.

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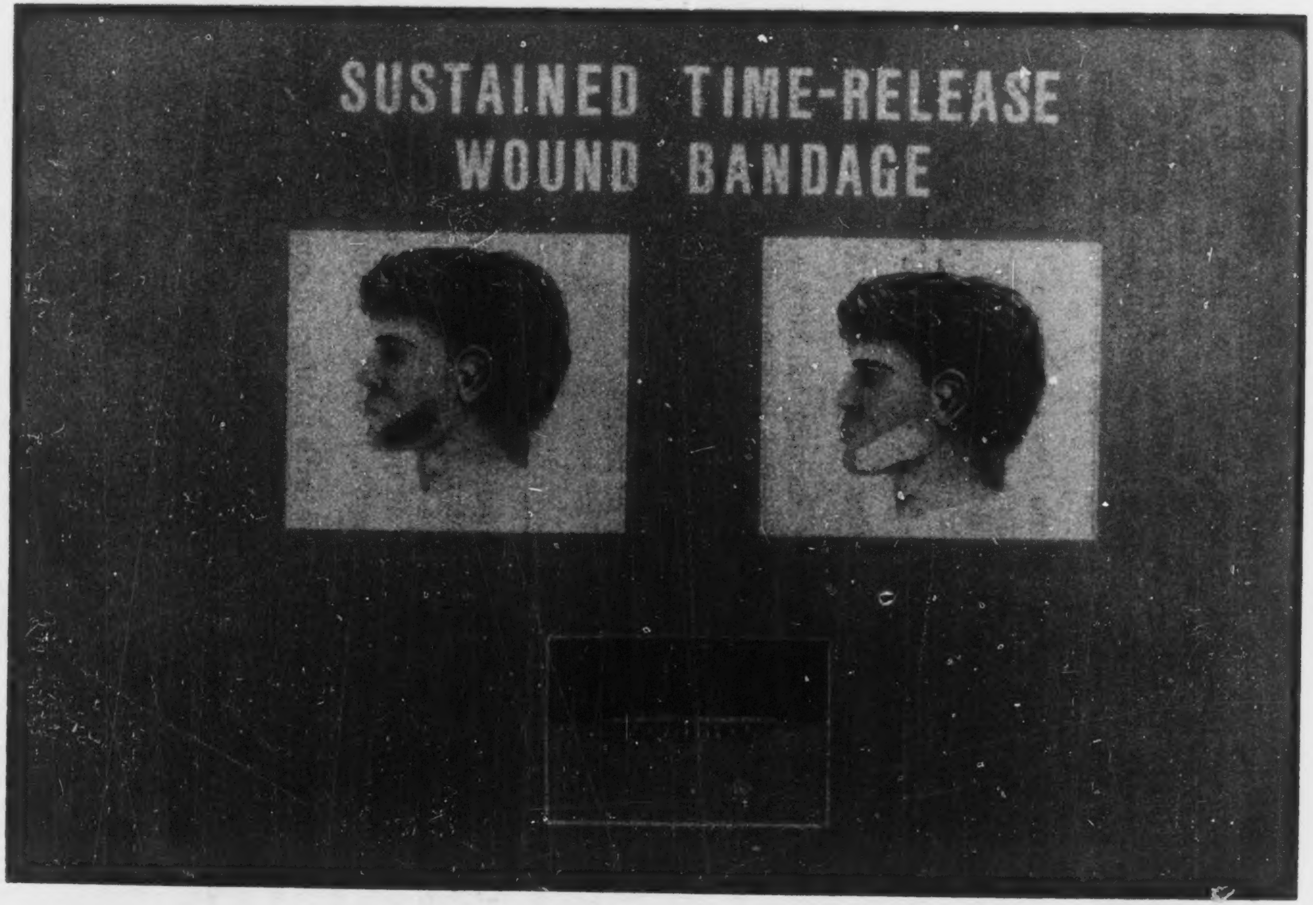

SUSTAINED TIME-RELEASE
WOUND BANDAGE

General WAGNER. Eighteen percent of the injuries to soldiers and even a higher percentage to tankers are wounds in the face where it tears away part of the jaw. That is about a one-to-two-year recovery period because they have to remove small pieces of bone from the hip and plant them there and hope it takes and grows on to your bone, a very difficult operation to make it very successful.

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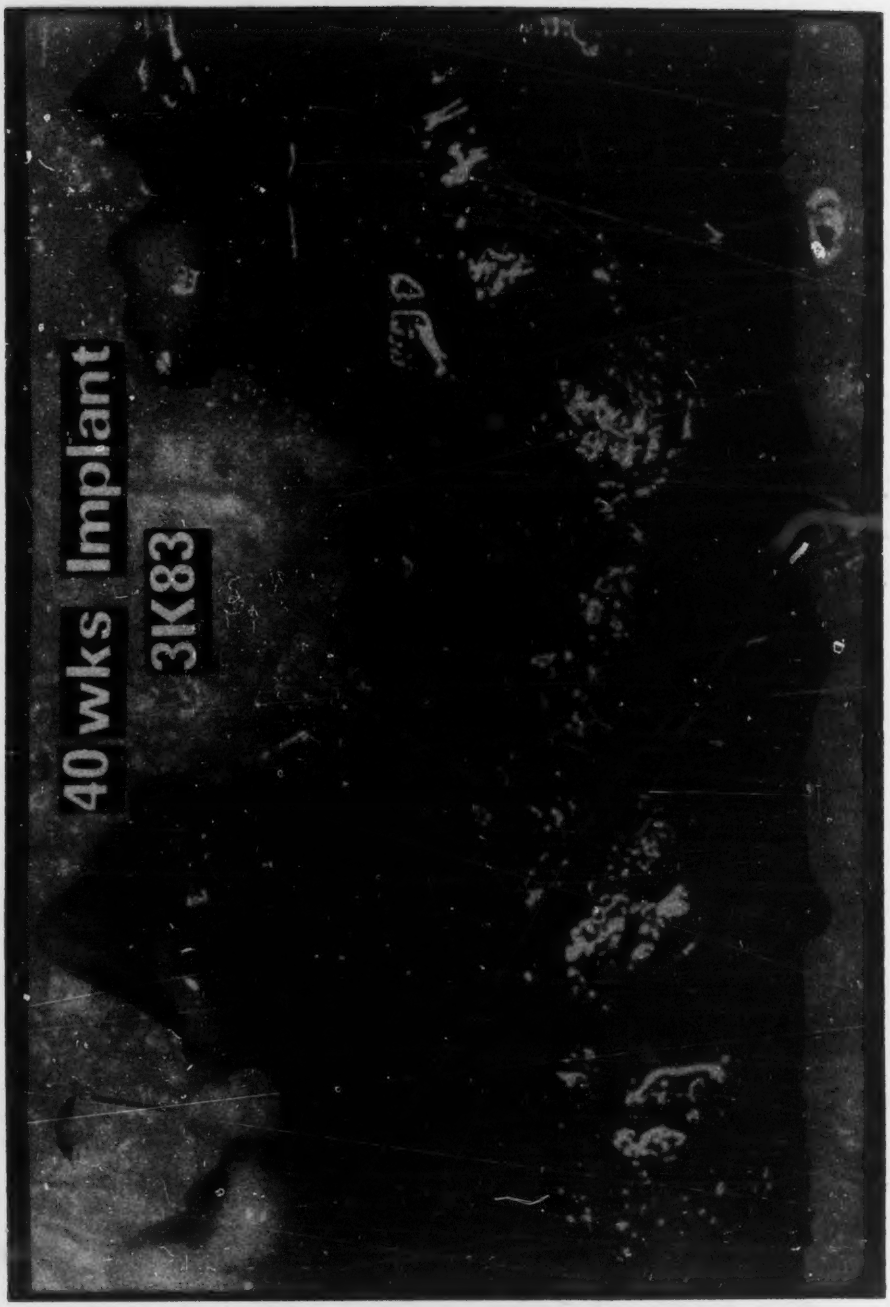
40 wks Implant
3K83

General **Wagner**. Our people in the medical arena have come up with biodegradable bone that can be formed to the shape of the jawbone. The screw also can be put in there because it is biodegradable and the bone grows to that. It allows a more rapid recovery from the wound and is more successful than we have achieved in the past.

These are things we think are important in the medical R&D and we have to keep that program going.

With that background, we are available for questions and I think Dr. Sculley has a statement.

STATEMENT OF DR. SCULLEY

Mr. **Chappell**. Doctor, your statement will be in the record. Would you like to summarize or add anything to what the General said?

Dr. **Sculley**. Just for emphasis, I know General Wagner went into the details on his early charts, but I would ask that the committee look at the Army's research, development and acquisition request in its entirety rather than focus on the RDT&E request alone.

I say that because while we show real growth in RDT&E, it was a clear, conscious decision to show growth in the R&D arena at the same time of showing a negative growth of some five percent in the procurement accounts.

This was done again with great deliberation and not without pain. Our procurement request is some $5 billion less than we had projected at this same time last year and in your review of the Army's request, I would just ask that you look at it in its entirety.

Gramm-Rudman-Hollings

Mr. **Chappell**. What does Gramm-Rudman-Hollings do for you?

Mr. **Sculley**. In our procurement accounts, the numbers are still in negotiation with the contractors. This year's request of $18.6 billion will show a real decline. Taken together the request for R&D and procurement shows zero real growth. I just ask that it be looked at in its entirety.

[The statement follows:]

MR. CHAIRMAN, MEMBERS OF THE COMMITTEE: IT IS A PRIVILEGE FOR ME TO APPEAR BEFORE YOU TO PRESENT THE FISCAL YEAR 1987 BUDGET REQUEST FOR THE ARMY'S RESEARCH, DEVELOPMENT, TEST AND EVALUATION PROGRAM.

FIFTEEN YEARS AGO WE RECOGNIZED THE NEED TO MODERNIZE IN ALL AREAS, BUT PARTICULARLY IN OUR PRINCIPAL WEAPON SYSTEMS. AT THAT TIME THE SOVIETS WERE DEVELOPING AND DEPLOYING WEAPON SYSTEMS AT RATES WHICH INDICATED THAT THEY INTENDED TO ESTABLISH A CLEAR NUMERICAL SUPERIORITY OVER THE U.S. AND ITS NATO ALLIES IN TERMS OF MODERN CONVENTIONAL MILITARY FORCES.

THE SOVIET FORCES AND THOSE OF THE OTHER WARSAW PACT MEMBERS WERE THEN ALREADY NUMERICALLY SUPERIOR BUT INFERIOR IN THE QUALITY OF THEIR EQUIPMENT. ACCORDINGLY, THE U.S. AND OUR NATO ALLIES ENJOYED A SUBSTANTIAL QUALITATIVE SUPERIORITY. THE DETERRENCE OF OUR CONVENTIONAL FORCES DEPENDED LARGELY UPON THE UNCERTAINTIES THAT THIS QUALITATIVE DIFFERENCE CREATED FOR THE SOVIETS.

THE MODERNIZATION PROGRAM UPON WHICH WE HAD EMBARKED IN 1970 WAS DESIGNED TO EXPLOIT OUR TECHNOLOGY AND TO USE IT TO FIELD NEW SYSTEMS WHICH WOULD MAINTAIN OUR MARGIN OF QUALITATIVE SUPERIORITY. WITH YOUR SUPPORT, THAT PROGRAM HAS GONE WELL. WE HAVE DEVELOPED MODERN SYSTEMS AND ARE NOW ACQUIRING THEM AND MODERNIZING OUR FORCE. GENERAL WAGNER WILL BE DISCUSSING IN SOME DETAIL OUR CURRENT STATUS AND WHAT OUR FISCAL YEAR 1987 REQUEST WILL ACCOMPLISH.

AS WE HAVE PROCEEDED WITH OUR MODERNIZATION PROGRAM, THE SOVIETS HAVE MOVED MUCH MORE AGGRESSIVELY THAN ANY OF OUR ESTIMATES PREDICTED. THEY HAVE INCREASED THEIR NUMERICAL ADVANTAGE MORE THAN EXPECTED AND, MORE ALARMING, HAVE REDUCED AND, IN SOME CASES, REVERSED THE QUALITATIVE ADVANTAGE WE HELD. IN EUROPE THIS MEANS THAT SOVIET AND WARSAW PACT FORCES HAVE FIELDED A MODERN MOTORIZED AND ARMORED FORCE, A DENSE MULTI-SYSTEM AIR DEFENSE, MODERN ATTACK AIRCRAFT AND HELICOPTERS, AND A GROWING CONVENTIONAL TACTICAL MISSILE THREAT. THUS, AT LEAST BY MANY OF THE MEASURES WHICH WE HAVE USED TO COMPARE OUR FORCES, WE HAVE INDEED LOST GROUND. IN THESE RESPECTS, THE UNCERTAINTIES FOR THE SOVIETS IN CONDUCTING A CONVENTIONAL CAMPAIGN IN EUROPE HAVE BEEN REDUCED AND SO, ACCORDINGLY, HAS THE DETERRENT POSTURE OF THE U.S. AND NATO FORCES.

AT THE SAME TIME, THE MILITARY SITUATION IN THE THIRD WORLD HAS WORSENED. SOVIET MILITARY POWER AND INFLUENCE HAVE BEEN INCREASINGLY PROJECTED THERE. IN SOUTHEAST ASIA, IN PARTICULAR, SOVIET MILITARY EQUIPMENT HAS BEEN USED TO ESTABLISH LARGE AND MODERN MECHANIZED AND ARMORED FORCES. THESE AND DEVELOPMENTS IN AFRICA AND LATIN AMERICA CONFRONT US WITH A MILITARIZED THIRD WORLD IN WHICH THE PROSPECTS FOR U.S. MILITARY OPERATIONS ARE BECOMING INCREASINGLY FORMIDABLE.

WHILE WE HAVE BEEN MODERNIZING, THE SOVIETS HAVE BEEN INCREASING THEIR NUMERICAL ADVANTAGE AND ELIMINATING THE QUALITATIVE GAP. IN THE AREA OF QUALITY, THE SOVIETS HAVE DONE THIS, AT LEAST IN PART, BY ACQUIRING OUR TECHNOLOGY. HAD WE DEPENDED ONLY ON EQUIPMENT MODERNIZATION, OUR DIFFICULTIES NOW WOULD BE VERY SERIOUS, IF NOT EXTREME. HOWEVER, AS THESE SOVIET DEVELOPMENTS EMERGED, OUR MILITARY PLANNERS RECOGNIZED THE NEED TO MEET THEM, FIRST, BY DEVELOPING NEW DOCTRINE FOR THE EMPLOYMENT OF OUR NEW WEAPONS AND, SECOND, BY DEVISING NEW ORGANIZATIONS FOR OUR LIGHT FORCES, AS PART OF THE ARMY OF EXELLENCE PROGRAM, TO MEET OUR NEW AND INCREASING WORLDWIDE COMMITMENTS.

AIRLAND BATTLE IS A MAJOR ADVANCE IN DOCTRINE WHICH ADDRESSES THE BATTLE ACTIVITY IN THE REAR, CLOSE-IN, AND DEEP AREAS AS CONCURRENT, COORDINATED OPERATIONS. THIS DOCTRINAL DEVELOPMENT IS PARTICULARLY BOLD IN ITS CONCEPT FOR DEEP ATTACK, THAT IS, PROJECTING COMBAT POWER DEEP TO ATTACK THE SECOND AND THIRD ECHELONS OF THE ENEMY FORCE. THIS ASPECT OF AIRLAND BATTLE IS GENERALLY DESCRIBED AS PRODUCING DELAY, DISRUPTION, AND ATTRITION OF THESE ECHELONS BUT, BY DOING THIS, IT DOES MUCH MORE. DEEP ATTACK IN AIRLAND BATTLE PLACES THE WHOLE CONCEPT OF SOVIET CAMPAIGN OPERATIONS AT RISK. THUS, AS WE IMPLEMENT THIS DOCTRINE, WE WILL INCREASE GREATLY THE MARGIN OF UNCERTAINLY FOR THE SOVIETS REGARDING THE OUTCOME OF ANY CONVENTIONAL CAMPAIGN AND, THEREFORE, RESTORE THE DETERRENT POSTURE OF OUR CONVENTIONAL FORCES.

AIRLAND BATTLE IS ALREADY BEING IMPLEMENTED WITH THE FORCES AND EQUIPMENT NOW IN THE FIELD. HOWEVER, THE FULL DEVELOPMENT OF THE POWER OF THIS CONCEPT DEPENDS CRITICALLY ON THE COMPLETION OF OUR MODERNIZATION PROGRAM, THE EXPLOITATION OF EMERGING TECHNOLOGIES IN SENSORS TO SEE DEEP, IN SMART MUNITIONS TO STRIKE DEEP, AND IN DATA PROCESSING AND TELECOMMUNICATIONS TO MANAGE THESE RESOURCES RAPIDLY. OUR SCIENTIFIC AND TECHNOLOGY BASE IN THE U.S. POSITIONS US ALMOST UNIQUELY TO DO THIS AND, THUS, TO ESTABLISH A MAJOR ADVANTAGE OVER OUR ADVERSARIES IN EMPLOYING WEAPONS ON A MODERN BATTLEFIELD.

OUR PLANS FOR IMPROVING THE CAPABILITY OF OUR LIGHT FORCES ALSO REQUIRES AN AGGRESSIVE APPLIED TECHNOLOGY PROGRAM. THE REORGANIZATION OF THESE FORCES UNDER THE ARMY OF EXCELLENCE PROGRAM WILL PROVIDE FOR GREATLY INCREASED DEPLOYABILITY. THESE FORCES, HOWEVER, WILL NEED GREATER FIREPOWER TO MEET MODERN MECHANIZED AND ARMORED THREATS, AND DEVELOPMENTS IN THIS AREA ALSO REQUIRE AN AGGRESSIVE TECHNOLOGY PROGRAM.

IN SUMMARY, TO MEET THE MILITARY CHALLENGE WE HAVE DESCRIBED, WE MUST DO THREE THINGS: (1) COMPLETE THE ACQUISITION PROGRAM NEEDED TO MODERNIZE ALL UNITS IN OUR FORCE, (2) EXPLOIT OUR ADVANTAGE IN SCIENCE AND TECHNOLOGY TO ADD VALUE TO THAT FORCE BY DEVELOPING THE SYSTEMS NEEDED TO IMPLEMENT AIRLAND BATTLE AND IMPROVE THE COMBAT POWER OF OUR LIGHT FORCES, AND (3) CONTINUE OUR R&D TO SEIZE THE OPPORTUNITIES OUR EMERGING TECHNOLOGIES PROVIDE TO CREATE NEW CAPABILITIES AND TO DEVELOP GREATLY IMPROVED SYSTEMS.

WE MUST RECOGNIZE THAT THE FUNDAMENTAL ADVANTAGE WE HAVE OVER OUR ADVERSARY IS BASED ON TWO ESSENTIAL INGREDIENTS: (1) THE EXPEDITIOUS AND EFFECTIVELY MANAGED COMPLETION OF OUR MODERNIZATION PROGRAM, AND (2) THE BASE OF SCIENCE AND TECHNOLOGY IN THE U.S. AND IN THE NATO NATIONS. IF WE DO NOT AGGRESSIVELY COMPLETE OUR MODERNIZATION WHILE PUSHING OUR R&D PROGRAMS TO EXPLOIT THIS ADVANTAGE, WE WILL RISK A SERIOUS LOSS IN THE DETERRENT VALUE OF OUR CONVENTIONAL FORCES.

Mr. CHAPPELL. Since I have asked so many questions so far, Mr. McDade, I yield to you at this point.

M1 TANK ENGINE

Let's talk about the M1 tank, General.

Mr. McDADE. Anything you want to do is fine with me, Mr. Chairman.

Last year, $15,000,000 was added above the budget for test and evaluation of a transverse mounted engine for the M1 tank.

What is the current status of this effort?

Dr. SCULLEY. With your permission, Mr. McDade, maybe I could take a cut at that.

Mr. McDADE. Please.

Dr. SCULLEY. I have been on the record in previous hearings not to be boxed in looking at alternatives to the current M1 power plant. I am not negative about anything, yet I didn't want to be so constrained that we couldn't look at reasonable alternatives.

Mr. McDADE. There are press reports that would indicate that the TME doesn't meet Army requirements. Is that accurate?

Dr. SCULLEY. The initial analysis seems to support that, but again I am not against using some of these moneys to actually evaluate some of these engines in an existing chassis. I just wanted to be restricted at looking at just that alternative.

At this point in time, it is true that we have no formal operational requirement for the space, but I think General Wagner really has touched upon that it may allow for additional sensor packages, crew size increase et cetera.

At the same time, I am very interested in a proposal that I don't know a great deal about in-depth, but advocated by General Motors, that would in fact look at some modern technology in diesel engines.

Certainly the M1 decision on power plant is rather old at this time, and I think there have been significant changes in both diesel engine technology and turbine engine technology. As we look toward the nineties for future power plants, not just for the M1, but for heavy fighting vehicles in the future, I think it is prudent at this time to keep the doors open.

Mr. McDADE. Well, what specifically do you intend to do with the $15 million that was provided?

General WAGNER. Right now there is a report and a study that has been prepared that has been forwarded up to Dr. Sculley and his people are looking at it to determine whether we would use that $15 million to evaluate the transverse engine in a test bed for possible application in the future or if we should come back and say we shouldn't spend it. He has to make a decision on that in the near future.

Mr. McDADE. Provide for the record a project description and milestone chart.

[The information follows:]

The Department of the Army tasked the Army Materiel Command to prepare a report that would answer your question. That report is being reviewed by the Assistant Secretary of the Army for Research, Development and Acquisition. Upon approval, the report will be forwarded.

Mr. McDade. What changes would be required if the M1 tank were to be equipped with a TME?

General Wagner. They would have to redesign the rear engine compartment. It would take different bracing—it could be done, but it is not something that you would do without a redesign of the vehicle and then have to redesign your production line to crank it in. It is not a simple thing that you could put in a matter of months.

It would take a development and test program to put it into production.

Mr. McDade. What would it cost to develop and to incorporate in production?

General Wagner. I will have to provide that.

[The information follows:]

The Army has looked at the TME for the M1 tank and concluded that at this time, it would not be cost effective to retrofit a modified engine for the fleet of 7467 tanks. Preliminary Army estimates are $205 million in preproduction costs and an additional $30K per vehicle in production cost increase.

Mr. McDade. What are the logistics implications of a TME?

General Wagner. There could be cost savings because the transverse engine has had improvements in it as far as efficiency so it should cut down on fuel consumption.

Mr. Livingston. I thought they had a prototype. They haven't already designed it?

General Wagner. They have designs of the engine and the transmission hooking it together. We have not put one in a vehicle, so we havent' designed the vehicle rear engine compartment to drop it in. It can be done and that is what we are looking at now.

M1 TANK TRACK

Mr. McDade. After a lot of encouragement by this committee, the Army has been examining possible replacements for the current track used on the M1 tank. Preliminary testing was made of a German design in 1984. In July 1985, the Army began tests in the U.S. of competing German and U.S. design.

Why was that testing suspended?

General Wagner. Primarily because they both failed. We were looking at a track that would give us a substantial increase in mileage. Quite obviously the key is cost per mile. They just didn't come through.

In the case of the Diehl track, which is the German track, the road wheel wear was excessive. In the case of the FMC, the track bushing wear was excessive. They are looking at the track again and when it is fixed, they will come back to us if everything is successful, we will probably start testing again this summer.

Mr. McDade. When was the suspension imposed?

General Wagner. October 1985.

Mr. McDade. How must testing has taken place prior to suspension?

General Wagner. I will have to provide the specific miles for the record, sir. I just can't remember.

[The information follows:]

The testing was suspended and halted in mid-October. At that point in test the Diehl track had 18,000 miles and the FMC had 11,000 miles.

Mr. McDade. When do you expect testing to resume?

[The information follows:]

Screening of fixes to the problems experienced earlier will begin in mid-March for Diehl and in May for FMC. Full testing will resume in August for systems that have demonstrated solutions to earlier problems.

Mr. McDade. What criteria have been developed for determining which alternative is to be chosen? What are you looking at?

General Wagner. Cost per mile. In other words, what is the cost of the track system to include the road wheels, the sprockets and the track per mile of operation. Today we get about 850 miles on our track. We feel that that is not satisfactory.

NEXT GENERATION TANK

Mr. McDade. The M1 tank is now being fielded in large numbers. Given the time it took to develop that system, it seems reasonable for the Army to be starting now on plans for a successor.

What, if any, are those plans?

General Wagner. Sir, we have a major study group that has been formed under the direction of the Chief of Staff headed up by Major General Sunell that is looking at several things.

First, it is looking at should we continue production of the M1 tank to prevent the line from going cold as it will now in the 1991–92 time frame, depending on the production rate. They are looking at what should be the follow-on. Should it be a modification of the M1 or should it be a member of a new family of vehicles with commonality among fighting vehicles, artillery, things of that nature.

Their initial input will be in next month to us. They will give us more information by the end of the summer and by next year they will have their full recommendations in to the Chief of Staff for a decision.

Mr. McDade. What kind of technologies are being considered for the new tank?

General Wagner. First of all, I don't think if we are going to build any tank in the 1990s it is going to be revolutionary. It will be evolutionary. We are looking at the lethal systems on it, is it going to have the same gun as we have today, is it going to have one that we can up-gun? We are looking at electro-magnetic propulsion guns, breakthroughs in armor, improved gas turbines and advanced diesel engines, and we are looking at composites to lighten it up.

Mr. McDade. How much specifically is in the 1987 budget for a successor to the M1 tank?

General Wagner. Nothing. I should correct that. There are dollars in the technology base such as engine developments, that may eventually be applied to a future armor.

Mr. McDade. That is the number I am looking for.

General Wagner. Specific vehicle, no. I can provide that detail for the record.

[The information follows:]

There is no money in the FY 1987 budget to specifically begin work on a successor to the M1 tank.

M1 TANK TRACK

Mr. CHAPPELL. Would the gentleman yield?

Back to the track. You say you are only getting 850 miles. Is that on the paved-type road——

Dr. SCULLEY. That is the mean life. What is equally troublesome is the variance in that figure. We have experienced a far shorter life and we have experienced life approaching 1,200 to 1,300 miles in some locations under certain weather conditions.

As part of the R&D effort, we need to better understand the components of failure, the factors that influence failure, and on that basis, direct our research in areas that would extend the life of the track.

But in all honesty, we do not today understand the components of failure of tracked vehicles.

General WAGNER. We can build steel tracks that we know we will get more mileage out of and if we were only interested in war, we would do that, but today where we have to operate on the hard surface roads around the world, we can't do that. We have to have either rubber or a composition like rubber for the track.

The Israelis have gone on a majority of their tanks to steel track because they keep them in the area where they are going to operate or transport them there on heavy equipment transporters, but where we have to operate all over the world today, we have to have a rubber or composition track to save those roads. That is the breakdown that we have had in all the track.

The Germans and French have the same problem. None of them have come up with a very durable track.

Mr. MCDADE. How about the Soviets?

General WAGNER. They use steel track in most cases.

Dr. SCULLEY. There is a significant cost savings available if we can solve the problem. Some estimates run $17 a mile just in track costs on the tanks. It is on our front burner and we hope that the next round with Diehl and FMC yield some promising results.

Mr. MCDADE. Does that mean when the track wears out you have to put on new ones or can you put on just the treads?

General WAGNER. With the particular track we have you put on a new track, but it can be rebuilt. They take it apart and put new rubber on it, but you do have to replace the track when it wears out because it wears all the rubber off and you are down to steel. You then have the problem of running steel on the roads.

Mr. MCDADE. Does it make sense to produce a steel track and use it in time of war and the rest of the time use what you have now?

General WAGNER. Probably not because when you look at scenarios in wartime, the total number of miles that your tanks are going to run is not that significant. You put your miles on in peacetime.

In wartime there will be very few tanks that will probably run 850 miles after that war starts, so it probably wouldn't be that effective just to save it for wartime.

Mr. MCDADE. When you resume tests, I am assuming that any new designs would be part of the competition if somebody should submit them, is that the case?

General WAGNER. If someone comes in with a better design than the other two companies, we would go for it in a minute.

NEW TACTICAL TRUCKS

Mr. McDade. Let's talk about tactical trucks.

Your are requesting fiscal year 1987 R&D funds to procure prototype trucks. A new medium truck, budgeted at $11.6 million for fiscal year 1987, and a new heavy truck, budgeted at $36.2 million for fiscal year 1987, are projected as replacements for existing assets.

Last year the Congress provided $1 million for the Army to conduct an evaluation of its truck requirements. Have those funds been used?

Dr. Sculley. I don't know if the entire amount has been spent yet.

Mr. McDade. You have spent some of it?

Dr. Sculley. Yes, we have.

[Additional information follows:]

The funds are being used to continue development of Family of Medium Tactical Vehicles (FMTV) and Family of Heavy Tactical Vehicles (FHTV) specification requirements.

Mr. McDade. Has the evaluation been completed and if so, what are the results?

Dr. Sculley. It has not been completed, sir. We have an organizational and operational plan for both the medium and the heavy families of tactical vehicles and the required operational capability in each case is due to headquarters in April of this year.

Mr. McDade. In April, you will have an ROC for the medium truck and for the heavy truck?

Dr. Sculley. That is correct.

Mr. McDade. The Army estimates that a total of $54.8 million will be needed to test heavy vehicle prototypes, and a total of $51.8 million will be needed to test medium vehicle prototypes. The estimates provided by the Army last year for the same activities were $30.4 million and $46.3 million, respectively.

How were these estimates derived?

General Wagner. I can't tell you specifically how they were derived, but I do know that about $53 million for the medium truck is going to be spent over three years and there is going to be maybe more than one version of that family because we will look at something maybe in the three-ton level for our light divisions and then six tons for the heavier side.

This would be a mix with as much commonality as possible. That would increase the cost. In the heavy vehicles, there will be one weighing in the eight-ton category and one in about the fifteen-ton category, so we think the dollars we have now are a closer estimate as to what it is going to cost us.

Mr. McDade. Well, the statement by the Army is that there is no development work involved. Is that correct?

Dr. Sculley. That is correct.,

Mr. McDade. Why will it cost over $100 million to procure and test a few prototype vehicles? Why is the cost so high?

Dr. Sculley. Until I get to the base of the cost estimate, it is difficult to answer with the degree of definity that I should. However, I can tell you just that in the heavy truck program, the eight ton, the fifteen ton without crane, the fifteen ton with a crane, and a number of variants; testing and evaluation has become expensive. In an era of a nondevelopmental approach with more people bringing items to the table, you can expect your test and evaluation costs to go up.

I think long term with that level of test and evaluation and the competition that it brings, it will pay off in reduced procurement costs.

Mr. **McDade**. We hope so because we are concerned about the number and the sharp increase that is reflected this year, so we would encourage you to look at that.

Dr. **Sculley**. We will provide the details.

[The information follows:]

RDTE estimates for the families of medium and heavy tactical vehicles were developed by validated engineering cost estimates. The over $100M is required for procurement and test of the numerous vehicles of different body styles and payloads needed for valid test samples. Under the family concepts, two payload variants with numerous body styles are anticipated in the medium family and three Palletized Loading System (PLS) payload variants initially in the heavy family. Although not final, acquisition plans for prototype testing contemplate medium family acquisition of 15 trucks and 5 trailers each from three contractors and heavy family acquisition of 18 trucks, 8 trailers and 28 flatracks each from three contractors. Body style mix for both programs has not yet been finalized. The medium family RDTE funding, erroneously projected in the FY 86 President's Budget in FY 84 constant dollars, should have been $52.5M. The heavy family RDTE estimate was revised because of restructuring from a three to two year prototyping effort, refinement of user requirements and input from industry.

Mr. **Chappell**. We just got through developing and procuring the ten-ton truck. What is the justification for now starting into a new program on the new truck?

General **Wagner**. This particular truck will be that truck that will carry us past the year 2000. It is going to be based on a chassis we call the palletized loading system which we think will be more effective on the battlefield. This could be described as similar to a Dempster Dumpster. A truck today is single purpose. If you look at a cargo truck, it is a cargo truck. If you look at a fuel truck, that is what it is.

We are looking at a truck that we can change the configuration of it depending on the command of the user.

If you are in the exploitation phase in combat, you burn a lot of fuel and not much ammunition, so you want to use it as a fuel carrier.

We feel we can get more efficiency out of the truck companies if we have a dual capability. The British have a similar system they are developing now and putting into their inventory. We hope to do it in the heavier units. We have tested a lightweight prototype of this in the Ninth Division and it was very effective.

Mr. **Chappell**. And your present ten-ton truck doesn't have the capability?

General **Wagner**. Not today. It is a good truck, but it doesn't have that multiple capability.

Mr. **Chappell**. Have the Marines been doing a lot of work in this area aleady?

General **Wagner**. Yes, sir, they have, and we follow their work very closely.

If it looks like this would be something that we should put into our forces and put into the competition, we would certainly do it.

Mr. **Chappell**. That is the LVS program?

General **Wagner**. Yes, sir.

Mr. **Chappell**. That truck was patterned pretty much after your truck, wasn't it? Doesn't it use much of the same power system, they just unhooked one type vehicle and put another on it? Isn't that essentially what they did?

General **Wagner**. It is very similar to one of the vehicles tested during the competitive selection of the 10 ton truck that we have today. They have made some improvements in it since that time.

Mr. **Chappell**. Is that the sort of thing you are looking at or an entirely new approach?

General **Wagner**. We are looking at a family making use of the new technology in central tire inflation, for example, composites and things of this nature so when the next truck comes along, it is not something with 10 or 15 year old technology, but is what we have today.

I think most of it will be off-the-shelf equipment because you will find in industry today that they are looking at more efficient engines and other components in trucks of this nature.

This will be an NDI approach. We will put out a specification. We are not going to design it in-house. They will come in with how they will meet that specification.

Mr. **Chappell**. Mr. AuCoin.

ADVANCED ANTITANK WEAPON SYSTEM—MEDIUM (AAWS-M)

Mr. **AuCoin**. Thank you, Mr. Chairman.

General Wagner, let me ask you a couple of questions about the AAWS-M program.

When I have talked to infantry officers at Benning or elsewhere and I ask them—and I am a former infantry soldier myself—when I asked them what their most serious deficiency is, what do they need more than anything else, the single answer I get is we need a medium anti-tank weapon that works.

Then they go on to explain that this means something that one man can carry around all morning, can use to defend his squad against the T-80 tanks all afternoon, and in the evening still be alive to tell the tale.

Mr. **AuCoin**. Milan doesn't make the grade because it is too heavy. Dragon doesn't make the grade because it can't penetrate from the front and it is not fire and forget, and they tell me that without a medium anti-tank mission light infantry is a suicide mission against the T-64 tank or better.

I offer a couple of points for your comment and then a couple of questions.

I really think it is appalling, without laying the blame, that we are sitting here in the year 1986 talking about an AAWS-M program that at this point is not sure where it is going, or if it is going anywhere.

It seems to me that we are about where we should have been in approximately 1980, 1981.

The second thing is that I am appalled at: what I have been hearing over the grapevine as I have pursued my interest here on the direction that the AAWS-M program is taking. Every infantry officer I talked to tells me that the next medium anti-tank weapon has to be fire-and-forget or the soldier isn't going to survive, but the grapevine says the Army's favorite AAWS–M candidate is the laser beam rider, and that has no fire and forget capability, so I am unable to understand why this is favored over a full-fire-and-forget concept such as tank breaker.

Why isn't the Dragon replacement further along than it is? This is an impossible long delay. And why is the favored candidate at this point a design that doesn't solve one of the Dragon's worst deficiencies, the absence of fire and forget?

General WAGNER. You are right, the greatest deficiency in the light infantry today and their first priority is an advanced anti-tank weapon system medium weighing about 45 pounds with range of 2,000 to 3,000 meters.

There have been a number of false starts on this program over the years primarily because of the threat. Every time they would come up with a system they thought would do the job, the threat would change and the new tank would become more difficult to take out.

We have been pushing very hard on this program in the last year and in fact we are starting it now. We have gone to the Department of Energy laboratories and said, "Can I destroy that threat tank with an advanced anti-tank weapon system with a warhead that weighs around 10 pounds" because that is about all the warhead that you could put into a system that weights 45 pounds.

They believe we can.

Now, I would tell you right now that despite the grapevine the laser beam rider is not the favorite approach.

Mr. AUCOIN. The grapevine is wrong then.

General WAGNER. I am not saying that I can't find someone down at the Missile Command that that wouldn't be his favorite approach. It is not my favorite approach and the Army has not made a decision, but at the same time with the very high speed system of that nature, it may be OK. The infantry is running tests to see if he really is more survivable with a system that is high speed of that type than he is with a fire and forget.

We are going out with a RFP within the next six weeks, and we hope to have industry bring in their technology. We would like to have four competitors, if possible, come in. We will then have a 27-month tech demo to see if they can do what they claim. It can be a beam rider to fly straight, a shaped trajectory fire and forget where it locks on and then goes in the top, or other approaches.

The advantage of it flying higher and coming in from above is that it is not as easy for him to smoke it and wipe out your sensor. Then we have to make the trade offs because a fire and forget will cost two or three times as much as a beam rider.

On the other hand, if it saves the man's life, that is worth it and second it shouldn't take as many if it is more effective. So we have to make the trade offs.

We want to do that quicker, in no more than 24 months, but we sent a copy of our RFP to industry and they came back and said, "We can't make it in 24 months. We need 27 months," so that is the reason we have stretched it.

We will then make a down select and go into full-scale development on the system.

Mr. AuCoin. In the period of time when the tests are being conducted, a full fire and forget capability is going to be one of the four systems being tested?

General Wagner. Sir, I hope so and I know some of the contractors that have picked up the RFP and looking at fire and forgets.

Mr. AuCoin. It seems to me that our report last year gave directions to the Army about including in AAWS–M the testing of a full fire and forget capability, so that it is considered in the competition.

The Army is aware of that?

Dr. Sculley. Absolutely.

General Wagner. Absolutely.

Mr. AuCoin. The Army is requesting $48.7 million for development of the AAWS–M. In its report on the 1986 appropriations, the committee directed the Army to provide by December 31, 1985 a detailed report on its plans for the AAWS–M. The committee subsequently received a two-page letter dated February 10, 1986, which was termed as "an interim report pending DSARC approval." That letter stated that fiscal year 1987 funding of AAWS/M would be $97 million. However, $48.7 million appears in the budget.

Can you explain the discrepancy between those two figures?

General Wagner. Yes, sir. We only need about $18 million in 1986 to start the concept development so we will be moving forward. $38-plus million that we have left from 1986 added to the funds that we have in 1987 willl be sufficient for the concept development that we have.

Part of the difference is that we were going into advanced development before instead of this shootoff. We think the shootoff will be cheaper because we expect industry to also put some of their funds into it.

Mr. AuCoin. So you are making use of carried-forward funds?

General Wagner. Yes, sir, from 1986.

Mr. AuCoin. When can the committee expect a report of the detail and specificity which we directed be submitted to us?

Dr. Sculley. We have had a Defense System Acquisition Review Council meeting originally scheduled for the first week of March deferred to the first week in April and I am sure that we can provide the committee with the specifics as a result of that DSARC.

Mr. AuCoin. Shortly after the first week in April?

Dr. Sculley. Yes, sir.

[Additional information follows:]

The DSARC for AAWS–M convened on 11 April 1986. Based on the AAWS–M acquisition strategy which provides for a 27-month Technology-Demonstration/Proof of Principle followed by a 36-month Full Scale Development (FSD) effort and subsequent production phase, the Army goal for the DSARC was to obtain approval to enter the 27-month "Tech-Demo"/Proof of Principle.

Approval was granted to enter the Tech-Demo phase. Additionally, the Army was directed to develop a plan to expedite the development and fielding of the TOW replacement known as the Advanced Antitank Weapon System-Heavy (AAWS–H).

The Secretary of Defense Decision Memorandum (SDDM) is expected in mid-May which will provide specific guidance to the Army on both the AAWS–M and AAWS–H programs.

Mr. **AuCoin**. Is there any major controversy about competitive demonstration of alternative technologies on the AAWS-M within the Army?

General **Wagner**. I don't believe there is now, sir. As I said, I think one of the things that has helped quite down the people that have said. "You can't make it" is when we went out and got the experts from the Department of Energy, who are very good, at Sandia and they said they thought we could make it, too. That has gotten us in good shape.

Mr. **AuCoin**. I am referring to an actual shootoff, not just a paper comment.

General **Wagner**. That is what that is. It is a demonstration where they will be fired.

Mr. **AuCoin**. The Congress provided $61.1 million of fiscal year 1986 funds for the AAWS-M program. The descriptive summary for fiscal year 1987 says that program activity in fiscal year 1986 will consist of "monitoring" and "discussions" but little else.

Please explain this. What specifically will the Army spend $61.1 million to do?

General **Wagner**. We will be spending the $18 million to get started and we will be carrying the majority of that forward to make up the difference between what we have asked for in the budget of $48.7 million and the remainder to carry the program through in 1987.

Mr. **AuCoin**. Provide the committee a specific description of the work to be done with the fiscal year 1987 funds, would you?

General **Wagner**. Yes, sir.

[The information follows:]

The main effort for the contractors begins in FY 1987. During this final year, the scope of work for the contractors includes system design engineering, system component testing, producibility engineering and planning (PEP), and the building of prototype hardware. A parallel warhead program will be started to maintain the capability to defeat the changing threat.

GROUND-LAUNCHED HELLFIRE

Mr. **AuCoin**. Dr. Sculley, you were quoted in the trade press as having said in March that serious consideration would be given to a ground-launced version of the Hellfire anti-tank missile.

Were you quoted accurately in those reports?

Dr. **Sculley**. As far as I am concerned, I was quoted accurately. That doesn't mean that everyone in the Army is in agreement with my opinions on Hellfire.

Mr. **AuCoin**. But you were quoted accurately?

Dr. **Sculley**. Yes.

Mr. **AuCoin**. What sort of serious consideration do you mean?

Dr. **Sculley**. In my visits to the ninth division, it was very clear that there is an apparent need for tank-killing capability. My discussions there revealed that a demonstration using Hellfire in a ground-launched version may be a very prudent experiment. Whether or not it has applications in mechanized infantry or armored divisions I really don't know, but I feel that in our motorized division and in our light divisions need something and we have a system that works.

I think we are getting it at an attractive price with the competition we have between Rockwell and Martin, and as you have often heard——

Mr. AuCoin. Let me ask you this: Have funds been requested in the fiscal year 1987 budget for such an effort?

Dr. Sculley. They have not.

Mr. AuCoin. They have not.

Dr. Sculley. They have not.

Mr. AuCoin. That is not very serious consideration.

Dr. Sculley. We must evaluate the possibilities before committing to a system.

Mr. AuCoin. As long ago as 1978, many interested parties in the Congress, this committee among them, were urging the Army to develop a ground-launched Hellfire. The Army declined for reasons which were never completely clear.

Are you aware of this history?

Dr. Sculley. I am aware of the history through discussions with your professional staff.

Mr. AuCoin. What has changed in the intervening years to cause the Army to change its position?

General Wagner. The threat, sir. We could take care of that threat with TOW without difficulty at the time that we first looked at the ground-launched Hellfire. That threat has grown significantly as he has fielded his T-80 and we know he is already working on his future Soviet tanks which he will probably start fielding in about two years.

At that time, it will be questionable whether the TOW can take it, at least frontally. He can take it from other angles, but there will be a question there. We can put a simple fix on the TOW today called a tandem warhead and we are going to do that. However, there is a question whether we can get through the future Soviet tanks frontally.

If I were going to war, I would field the ground-launched Hellfire. It can be done quickly and relatively cheaply. The problem we have with it is it takes another individual on the ground or airborne to lase for it on the target.

It is more complicated. However, we know it will do the job and I feel that if we get in a bind with the threat before we have a follow-on to TOW, this is a system that we should look at very seriously.

Mr. Chappell. Would you please provide for the record a description of any planned efforts to develop a ground-launched Hellfire capability, together with a funding profile.

[The information follows:]

Feasibility of a ground-launched Hellfire has been demonstrated, but the Army has neither an approved program for development nor programmed funding. The Army is however pursuing development of a Hellfire launcher for the UH-60A Black Hawk helicopter, in compliance with direction from Congress. This capability offers advantages over a ground-launched version such as rapid movement about the battlefield, integral communications for command and control, no changes in force structure, terrain obstacles avoidance, etc. Funding appropriated for this program is $15.0 million in FY 84 and $17.0 million in FY 86 for development. Testing is scheduled for completion by the second quarter FY 1987.

SENSE AND DESTROY ARMOR PROGRAM (SADARM)

Mr. **Chappell**. The Army is requesting $99.8 million to continue full-scale engineering development of the sense and destroy armor program. The committee has had serious reservations about SADARM in the past, mainly concerning adequate proof of principle, the need for more testing, cost and competition in development and production. Those concerns resulted in the issuance of certain specific directives by the appropriations conference in its fiscal year 1986 report.

When will an RFP be issued?

General **Wagner**. We are having a program review in May, sir, looking at the SADARM. We are looking at two versions of it, a warhead for the MLRS and a warhead for the 155 millimeter round. We would want competition on that.

The RFP, the test program and the ROC have all been structured in those two sizes to do that job. Probably the questions that you have on it and most people have had on it is the search pattern on the ground once you dispense it from the system.

It does not have the wide area search that some of the other munitions will have. However, we know it can be very effective, for example, against their artillery. It would be a super counter battery system.

With some of the systems that we have today for dispensing it, we think it may even be effective against a tank so we are carrying on with that program.

Mr. **Chappell**. When will the RFP be issued?

General **Wagner**. I will have to provide the specific date.

[The information follows:]

A competitive RFP is expected to be available in April 1986 for release to industry.

Mr. **Chappell**. Is the date of the RFP dependent on holding an ASARC?

Dr. **Sculley**. Yes, sir, and that ASARC is currently scheduled for the third quarter in fiscal year 1986.

Mr. **Chappell**. Since that is true, what consideration has the Army given to issuing the RFP prior to ASARC, and allowing proposal preparation and preparation for ASARC to proceed in parallel? Wouldn't that save time?

General **Wagner**. Yes, sir.

At this time the RFP is to be held up, but we will come back to you on that.

[The information follows:]

No. The Army intends to release the RFP prior to the formal program review.

Mr. **Chappell**. Give us your plan if you intend to go parallel, because we think it would save a lot of time for you and you agree.

Dr. **Sculley**. We do. We expect a four-year full-scale engineering development program after a contract award, so——

Mr. **Chappell**. You can't then tell us when you plan to award the contract?

General **Wagner**. We would release the RFP in April and probably put the contract out about two months later.

Mr. CHAPPELL. The conference directed that the RFP include, concurrent with ED, gun firings of modified advance development hardware.

Does it?

Dr. SCULLEY. It does include the test of the hardware. It includes the "Chicken Little" results and a design review are being incorporated into the programs.

Mr. CHAPPELL. What is the "Chicken Little" result?

General WAGNER. That is a test that is going on at Eglin Air Force Base. It has been a classified series of tests where we take foreign weapon systems and shoot at them with various munitions we have. The Israelis have been working with us on that program. We have learned a lot on what we can do particularly with top attack in that arena.

Mr. CHAPPELL. Are you able to tell us anything about the results from this Chicken Little test?

General WAGNER. The SADARM explosively formed penetrators have been able to penetrate more than we expect the top armor on threat tanks will be, so we believe that it can do the job.

Mr. CHAPPELL. The conference report stated that these gun firings are to be well instrumented, by which is meant the extensive use of telemetry. Describe how this requirement for telemetered gun firings is to be met.

General WAGNER. The amount of telemetry in the earlier tests probably was not as much as we would desire. We know the height of burst, what the penetration was and that sort of thing, but as we go on with these tests which we hope to do, we will continue to increase telemetry for that testing.

We worked this through the Air Force initially. They have been the major proponent for it and we tagged on to it.

Mr. CHAPPELL. When will these firings take place?

General WAGNER. I can't give you the specific date, sir, but that program does continue this year.

Mr. SERAPHIN. General, are you saying that these well instrumented firings of a modified AD hardware are going to be done as part of Chicken Little, or Chicken Little II, or something similar?

General WAGNER. We will be firing these tests in other places than just there. I am not sure whether we will shoot some of them in that or not. I would have to check that out.

Mr. CHAPPELL. How many firms do your view as being potential competitors for the development?

General WAGNER. At least two.

Mr. CHAPPELL. How about procurement?

General WAGNER. We would hope to keep those two in competiton as we go into procurement.

Mr. CHAPPELL. The conference directed the Army to ensure that the program schedule be structured realistically and managed prudently. The point is that progression from one phase to another is to be on the basis of specific technical accomplishment and risk reduction rather than on arbitrary calendar dates.

How long a time is now secheduled between contract award and choosing the winning competitor?

Dr. SCULLEY. I don't think that has been specifically identified, sir. We will be glad to provide that.

[The information follows:]

The engineering dvelopment contract is planned for June 1986 and down select to a winning submuition design is planned for 33 months later in fiscal year 1989.

General **Wagner**. We are scheduling the ED award for the third quarter so it would be a matter of a couple of months before we would be able to select the winner.

Mr. **Chappell**. You aren't getting into a situation where you are going to force a program to have an arbitrary 48 month development, are you?

General **Wagner**. We are getting out of that on all the programs. On the AAWS-M, we have a goal of 27 months. If it takes longer, we will take longer to do it right. We have an optimistic program for the Army tactical missile system, however, that will be based on proving we can do it by flying those missiles.

If it takes more time, we will use more, but there will be a cut point where we say it is not going to succeed. We are getting out of locking in on IOC dates and being pushed to the point where we make mistakes or don't do things prudently.

Mr. **Chappell**. Have the potential contractors been consulted?

General **Wagner**. Yes, sir. We went to the contractors on this, and talked to them about it and then we went to OSD and said this is a goal on the Army tactical missile program.

[Slide follows:]

ARMY TACTICAL MISSILE SYSTEM

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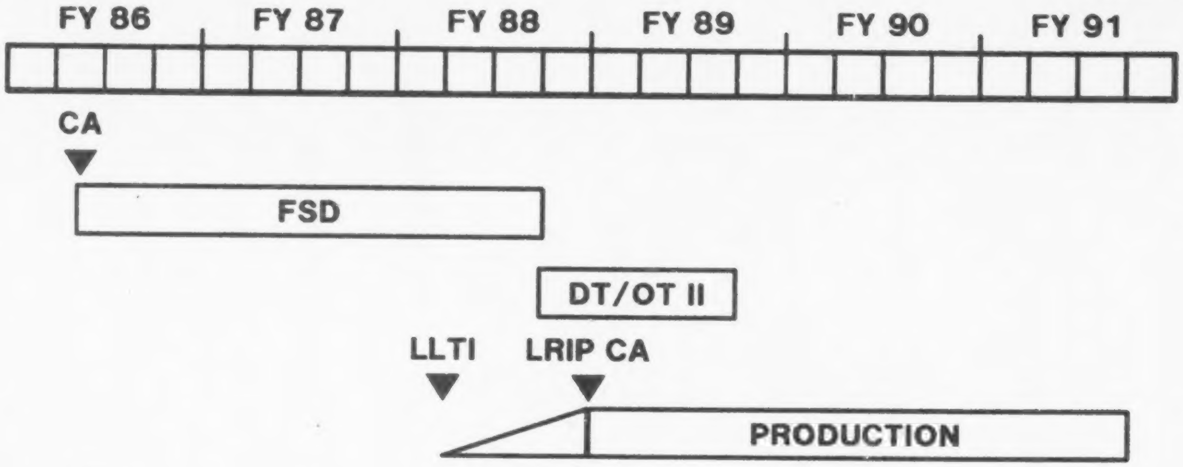
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General **Wagner**. We are going to make a contract award in fiscal year 1986 for full-scale development.

We are going to fire during this period about ten missiles, for example, in this program by the contractor, then we will fire 15 by the Army.

If that is successful and we think that we are ready to go into a OT II (Operational Test II) and into production, we will do it. If not, we have made provisions to fire 15 more missiles. If we don't make it in 40 missiles, we think we have a real problem with the basic problem. This is a goal because we want it as quickly as possible, but if we don't make it, we have made provisions and added extra equipment to continue that program.

Some people don't like that because they want to lock on an IOC (Initial Operational Capability) date. We have not locked on a date. In fact, this program can be expanded if necessary. We briefed this to the DSARC and they bought it. They said, "You think the Hill will buy this?" And I said "I think they will," and they said, "Go over and try it."

We have briefed this to the other committees and most of the committees have been supportive of this approach instead of locking on absolute dates.

Mr. **Chappell**. Does MICOM agree generally with this type of schedule approach?

General **Wagner**. Yes, sir. They were the ones that came up with this schedule.

SADARM DEVELOPMENT SCHEDULE

Mr. **Seraphin**. General, the import of Mr. Chappell's question was whether these schedules had been coordinated with potential SADARM contractors, rather than ATACMS contractors?

General **Wagner**. This particular program is for block 1-A ATACMS which has an APAM warhead. This is not a smart warhead.

Mr. **Seraphin**. The question is SADRAM, sir. Have MICOM and the potential SADARM contractors been consulted concerning the length of time between a contract award and the choosing of the winning competitor, is the question.

Dr. **Sculley**. I don't know the answer to that, but I would be happy to provide it. It is worth knowing.

[The information follows:]

Yes to both questions. The Smart Munitions Center at MICOM has been responsible for coordinating the program activities. MICOM, in particular the PM MLRS has played a key part in program planning and review. All known potential contractors were consulted.

General **Wagner**. Obviously they are the ones that conduct the source selection hearings so if they can't make it, the Army is not going to make it in that amount of time, no question.

Mr. **Chappell**. Are there risks involved in this schedule that would be avoided by adding more time for the competition to take place?

General **Wagner**. If you take a lot more time, you might do better. We know who the potential contractors are. They have been working on SADARM, so I am not sure it is that complicated. I will have to confirm that.

[The information follows:]

All areas called for in the SADARM Required Operational Capability (ROC) were reviewed in detail prior to its approval. Part of this review dwelled on a risk assessment as it related to several factors such as program schedule, required funding and testing necessary to meet the ROC. The areas noted as medium, yet acceptable, risk were associated with kill probability particularly under countermeasures. I am not sure that the addition of more time would result in risk avoidance.

Dr. SCULLEY. As a matter of policy, we have, I think, more than ever solicited the private sector's reviews on draft requests for proposals, get their views before going out with the final solicitation.

This includes requirements for data, length of time to respond, what we hope is candid criticism of these draft proposals because we know that alone we don't have the best idea on each and every item and I think we have found this approach to work.

We have taken the comments constructively and in many cases amended solicitations based on comments from industry. We intend to keep that policy.

Mr. CHAPPELL. Do you intend to obligate funds or expend any money on SADARM system qualification in DT/OT II until approved by the Committees on Appropriations?

Dr. SCULLEY. No, I don't think we will be in that far along. No. We will be back to you next year.

[The information follows:]

We have scheduled a Critical Design Review as called for in the Conference Report, and plan to conduct a Department level In Process Review (IPR) of the results of the CDR and down selection prior to reporting back to the Committees on Appropriations.

Mr. CHAPPELL. Please answer the unasked questions on SADARM for the record.

(CLERK'S NOTE.—Questions submitted for the record and the answers thereto follows:]

SADARM

QUESTION. When does the Army plan to award contracts?

General WAGNER. The Army intends to award the full scale development (FSD) contract after conducting the Program Review for a milestone II decision. Contract award is planned for June 1986.

QUESTION. The Conference directed that the RFP include, concurrent with ED, gun firings of modified advance development hardware. Does it?

General WAGNER. Yes. The RFP addresses this point which was also cited in the fiscal year 1986 Appropriation Conference language.

QUESTION. The Conference Report stated that these gun firings are to be well instrumented, by which is meant the extensive use of telemetry. Describe how this requirement for telemetered gun firings is to be met.

General WAGNER. Telemetry rounds are those in which the lethal mechanism (warhead) is replaced with the transmitter which radios (or tape records) critical sensor data or later analysis. The data available for analysis will allow the following questions to be answered:

What targets/false targets/countermeasures (CM) were encountered?

How many CM targets were declared valid targets?

The following questions cannot be answered with telemetry rounds:

What was the aimpoint?

Would the targets have been hit?

Where would the target have been hit?

To answer these critical questions the Army plans are to augment this testing by use of a live submunition with a lethal mechanism. The required data can best be obtained by having one live submunition and one telemetry submunition in each of the projectiles. The final details of this testing are under review and will be in the final approved Test and Evaluation Master Plan. We will apprise your committee staff members more fully at that time.

QUESTION. When will these firings take place?

General WAGNER. These gun firings are planned to be conducted approximately three to six months after contract.

QUESTION. Describe the test results being obtained from Chicken Little.

General WAGNER. The test, performed between August and December 1985, showed that the sensors performed as expected against all foreign targets; the sensors were degraded by countermeasures as expected and that this countermeasure degradation was consistent with the Army's Required Operational Capability. In one case, a contractor's sensor was degraded to a less than satisfactory capability against a certain type countermeasure; however, this contractor now plans to correct this deficiency by a change to the sensor algorithm. In sum, both the Army and the contractors involved gained considerable experience and learned invaluable lessons by this test.

QUESTION. The Committee, and subsequently the Conference, directed the Army to ensure full and continuing competition both in development of SADARM and in production, if the program proceeds to production. What steps have you taken to comply with that direction?

General WAGNER. As we now know there are at least three contractors who plan to respond to the competitive Request for Proposal (RFP) for the full scale development phase. There could be other industry sources who may bid. The Army will conduct a formal source selection process to select at least two competing contractors for FSD. Approximately 33 months after contract a winning submunition design will be chosen. This winner will be awarded a low rate production contract. At this point, full and open competition will be held and a second production source will be selected to produce to the winning design. Later, after this second source is producing at a competitive rate, a split buy will be held.

QUESTION. How was this time determined?

General WAGNER. It was determined by assessing the time needed to develop, fabricate and test at the sub assembly and assembly level. It considers appropriate known industry leadtimes to acquire key electrical components, such as large scale integrated circuits. A key objective of this schedule is to ensure that sufficient time is allocated to contractor development and test and not, as you have pointed out, on any "arbitrary calendar dates".

QUESTION. Does the Army believe this schedule to be realistic, or is this another example of forcing a program to have an arbitrary 48 month development?

General WAGNER. The Generic SADARM program schedule has received a considerable degree of high level scrutiny by Headquarters, U.S. Army Materiel Command and the Department. We believe it to be realistic and achievable. There are no arbitrary dates or events in the 48 month program. If it takes less or more time than this, so be it. Time is secondary to the development and production of an effective munition.

[CLERK'S NOTE.—End of questions submitted for the record.]

HELLFIRE ON BLACK HAWK

Mr. CHAPPELL. The fiscal year 1986 RDT&E appropriation provided $17 million to acquire a capability to launch Hellfire missiles from Black Hawk helicopters. Those funds were specified as being for completion of development activities and to initiate low-rate initial production.

In its fiscal year 1986 report, this Committee directed the Army to include funds for subsequent procurement in the fiscal year 1987 budget.

Dr. SCULLEY. Not in the 1987 request.

Mr. CHAPPELL. Why is that?

Dr. SCULLEY. Again, while the Army supports putting Hellfire on the Black Hawk, the only procurement that we have in 1987 is for the adaptation kits for the Black Hawk. It is fundamentally a question of priority, affordability, as well as whether we are ready to move out any faster.

We are, as I mentioned here in my early summary, down some $5 billion in the procurement accounts beneath where we thought we would be last year, but again, as with the ground-launched approach, I think it makes imminent sense to have the capability of using this very capable missile that I think we are getting at a competitively attractive price on the UH-60. It just make sense.

Mr. CHAPPELL. The Army Chief of Staff told us, two years running, that he wants it.

Dr. SCULLEY. That was my opinion.

General WAGNER. It has been the priority on the dollars. We took out $6 billion for our estimates in the FY87 budget last year for this. If you looked at our procurement budget last year and how much we said we were going to have in the 1987 budget and how much we submitted this year, it was down about $6 billion.

Mr. CHAPPELL. If I understand it correctly, you haven't requested any in fiscal year 1987.

General WAGNER. That is right, sir. It fell out and we had to take all those dollars out.

Mr. CHAPPELL. And yet the Committee told the Army to go forward with this. Is the Army ignoring that directive or can you give us some other reason why it hasn't been done?

Dr. SCULLEY. I wouldn't say that it is being ignored. It is not being done soon enough, I think, for the committee or in my own personal view.

Mr. CHAPPELL. How about 1988 funds? Do you plan to go forward with the 1988 funding?

Dr. SCULLEY. The Army plans in 1988, just as I did the same time last year, I planned to put it in 1987. I will support that throughout the process. I don't win every issue I tackle——

Mr. CHAPPELL. In other words, you asked for it and were turned down by OMB?

Dr. SCULLEY. No, sir. I sometimes lose battles within the Army, but it is a priority with me and I will make the same or better attempt this year to include a fiscal year 1988 request.

I am sorry I don't have a better answer.

Mr. CHAPPELL. Maybe you could get the word back to them that when the Committee directs something be done, it doesn't sit well when it isn't done.

Dr. SCULLEY. In all fairness, I think we are in a drastic situation today that we hadn't anticipated in March or April of 1985.

Mr. CHAPPELL. When is development complete?

Dr. SCULLEY. I think that is complete, sir.

Mr. CHAPPELL. When will low-rate initial production begin using fiscal year 1986 funds?

Dr. SCULLEY. I don't have the answer.

Other than the kits, we have nothing in procurement for the missile.

General WAGNER. That is a program, sir, that is being looked at from an affordability aspect as we are putting together our five-year program now. We don't have any Hellfire misssiles in the 1987 procurement because they got behind in deliveries and prior production approvals is being stretched through with the next production in 1988. It was an affordability question.

Mr. CHAPPELL. Wouldn't it be prudent for the Army when it finds it can't follow a Congressional directive to communicate with the Congress on that?

General WAGNER. Yes, sir.

Dr. SCULLEY. That is always a good idea, Mr. Chairman.

Mr. CHAPPELL. We think it is.

General WAGNER. We will finish that testing, sir, of the R&D model, in December of 1986. We will have a production readiness review in the second quarter of 1987 and then if we can afford it, we will have a competitive production contract award in 1988. We really would have had to rush to get it into production in 1987 anyway because R&D models won't be completed and tested until the end of this year.

COMMUNICATION CONTROL SYSTEM

Mr. CHAPPELL. Last year the Army testified that the Communication Control System had attained nearly 100 percent of the required functionality and would enter full-scale development in August 1985. Shortly thereafter, CCS was terminated.

Why was CCS terminated?

General **Wagner**. Sir, it was primarily terminated because as we looked at the need for it in the systems that we were going forward with, and as we advanced to the SINCGARS radio and so forth, we decided that it wasn't necessary. We spent $12.3 million in development of CCS, accepted models, ran a concept evaluation program on it and it seems we don't need it. We decided it wasn't worth spending $200 million to get something we could get by without.

Mr. **Chappell**. Since CCS and CCS modems were said to be essential to AFATDS, how will all of these unique communications functions be performed now?

General **Wagner**. They will be able to handle those communications with the standard communications in the units, for example, with the SINCGARS and also with PLRS JTIDS as we go forward.

Mr. **Chappell**. Does the ACCS requirement now include the CCS and CCS modem?

General **Wagner**. No, sir.

Mr. **Chappell**. Where is the communication software being developed?

General **Wagner**. The communication capability between them will use the equipment that is out there. In many cases it will be the enhanced PLRS and enhanced PLRS JTIDS capability. We can move that data on the battlefield without CCS.

[Additional information follows:]

General **Wagner**. The communications message/protocol software will be incorporated into the AFATDS design in lieu of a separate equipment/software development.

Mr. **Seraphin**. Are you saying that the Army has abandoned its plans to upgrade TACFIRE?

General **Wagner**. No. If it makes sense for the improvements that we can put in it as we go along and when we can move it out of the system.

Mr. **Seraphin**. But the TACFIRE modular improvement program was a multi-phased thing. The first phase was supposed to be upgrading TACFIRE with the CCS because the Army testified that the communication shortcomings were the single biggest problem with the TACFIRE.

[Additional information follows:]

General **Wagner**. No. If there are improvements that make sense and are affordable we will field them. The fielding of FIST-DMD, SINCGARS and PJH will make improvements in TACFIRE communications. The Army is evaluating a product improvement which will reduce the size of the DIVARTY TACFIRE from two shelters to a single shelter and reduce the ownership cost of TACFIRE. The Army will continue to upgrade the TACFIRE software throughout the life of the system. New software version are fielded to correct existing shortcomings and to incorporate new systems and munitions. Versions 7, 8, and 9 are in progress. Version 7 to be fielded in FY 1986 adds FIST-DMD, LANCE, and FIREFINDER interoperability, and corrects 32 software shortcomings. Version 8 scheduled for release in FY 88 implements FA Scatterable Mines, improves interoperability with the Meteorological Data System, modifies the operating system to incorporate the counterfire PIP, increases the capabilities of the BCS, and corrects 86 shortcomings. Version 9 planned to field in FY 1989, provides software for MLRS terminal homing munition interface, ATACMS APAM munitions, embedded encryption algorithms, and correction of additional shortcoming yet to be defined.

Mr. **Chappell**. It is hard to understand how you can say you don't need this improvement, and on the other hand you say you are going to improve TACFIRE where it makes sense.

General WAGNER. Part of the problem was that the CCS had so many false starts and problems that by the time it became available we were too far along to spend a lot of money putting it into the system.

Mr. CHAPPELL. False starts on TACFIRE——

General WAGNER. On the communications control, CCS.

Mr. CHAPPELL. What software functions originally intended to be included in the concept evaluation phase were deleted after the stop work order was rescinded?

Dr. SCULLEY. Would you repeat the question, Mr. Chairman, please.

Mr. CHAPPELL. What software functions originally intended to be included in the CEP were deleted after the stop work order was rescinded?

General WAGNER. I will have to provide that for the record, sir. I am not sure.

[The information follows:]

After the AFTDS stop work order was rescinded and Magnavox resumed work certain realignments to the CEP were required. Because of the exhaustive analysis by the Army leadership some functions which are to be accomplished by other nodes to the Army Command and Control System (ACCS) where deleted. No top level fire support functions were deleted from the originial CEP software requirements. Selected subfunctions which were being done in the other nodes of ACCS were deleted/deferred. In the Attack functional area, 9 subfunctions were deleted and 2 subfunctions were reduced. These subfunctions are done in the IEW node. In the Target Acquisition functional area preliminary target acquisition coverage analysis was deleted. This subfunction is contained in the IEW node. In the Target Damage Assessment functional area, the degree of automation was reduced. The Survey function was reduced by deleting automated preparation of survey plans. The Meteorological function was reduced by deleting automated tasking and scheduling. The functional area, of Movement Support was reduced by deleting those subfunctions being done by the CSS node. Logistical Planning, Supply Control, Personnel Control, and Maintenance Control were deleted. These functions are done by the CSS node. FA Fire Unit Mission Control was delcted. This function is done by the Battery Computer System which is retained as a subsystem of AFATDS.

Mr. CHAPPELL. What percentage of the original functionality remains in the down-scaled CEP?

[The information follows:]

The hierarchy of AFATDS requirements definition consists of 5 functional areas, 26 functions, 1,178 subfunctions and 15,000 processes. The adjustments to CEP software functional requirements resulted in a 17% reduction in the total lines of code.

Mr. CHAPPELL. For the record, provide a detailed breakdown of all expenditures and planned expenditures for fiscal year 1986.

[The information follows:]

A detailed breakout of all expenditures and planned expenditures as of 28 Feb 86 for FY 1986 is listed below:

[Dollars in thousands]

FY 86 expenditures	Obligated	Remain	Total
Government in House	$689	$1,268	$1,957
Program Support Contract	900	1,300	2,200
Program Support Follow-on	0	790	790
Baseline Cost Estimate	50	225	275
Software Development	4,423	3,369	7,792
Verification and Validation of Software	0	1,200	1,200
Life Cycle Software Support	140	615	755

[Dollars in thousands]

FY 86 expenditures	Obligated	Remain	Total
FSS/FST Contract Adjustments	0	1,932	1,932
Other Contracts	189	49	238
LFATDS (Lightweight TACFIRE) Support	296	1,164	1,460
Total	6,687	11,912	18,599

Mr. Chappell. How much money has been obligated and paid to the prime contractor as of March 1, 1986?

General Wagner. I will have to provide that to make sure that is the right amount.

[The information follows:]

As of 28 February 1986, $32,711,871 was obligated to the prime contractor; $25,039,144 was disbursed.

Mr. Chappell. Of the contractor's $10 million, how much has been invested as of March 1, 1986?

Mr. Wagner. We will provide that also for the record.

[The information follows:]

As of March 1, 1986 there has been no contractor investment. The contractor's investment will not begin until the government's funding ends in accordance with the re-negotiated contract.

ADVANCED FIELD ARTILLERY TACTICAL DATA SYSTEM (AFATDS)

Mr. Chappell. What is the total cost overrun on AFATDS to date? What was the projected cost overrun if the program had not been reduced in scope?

General Wagner. I am not aware of a cost overrun at this point unless you count all the pieces that may have been part of it earlier. The program now, I don't believe there has been any problem.

[Additional information follows:]

The AFATDS program has not had any cost overruns. If the Army had not forseen the potential duplication between AFATDS and the other ACCS nodes the increased cost would have been $18 million.

Mr. Chappell. Wouldn't you have to count all those?

General Wagner. Sir, the CCS was also to go on TACFIRE so you can put it on AFATDS if you want to. I guess you can count it all as you go forward, but it is not going to be a component of it.

Mr. Chappell. We are concerned it looks like there is a lot of money being spent and we don't have anything for it.

General Wagner. About $12 million on that program, yes, sir.

Mr. Chappell. What is the—the AFATDS contract signed in May 1984 required final versions of the operating system and applications software to be available 19 months after award (December 1985) and the concept evaluation phase (CEP) to commence 26 months later (July 1986). Training was to commence as early as January 1986. Is the AFATDS program on schedule?

General Wagner. About 30 to 40 days behind schedule now, if you count every day. We feel that that time can probably be made up.

Mr. Chappell. Based upon the original schedule for the CEP, how much has the program slipped?

General **Wagner**. At this point, if I remember right, we are about 40 days behind schedule. Whether some of that can be made up before the CEP, I can't say for sure.

Mr. **Chappell**. Will you provide a detailed schedule of program milestones suitable for monitoring progress between April 1, 1986 and completion of the CEP.

[The information follows:]

Milestone schedule for AFATDS CEP:

Month	*Event*
April 1986	Complete software release 2 testing.
July 1986	Complete software release 3 testing.
August 1986	Complete Key Personnel training.
September 1986	Complete software release 4 testing.
September 1986	Complete CEP testbed software integration.
October to November 1986.	HW/SW Integration and checkout, human factors test of system and screens.
January 1987	Begin CEP testing
February 1987	Complete CEP testing.
May 1987	Final CEP test report.

Mr. **Chappell**. What is the monthly expenditure rate on AFATDS?

General **Wagner**. We will provide that for the record.

Mr. **Chappell**. Do you know how many people are currently working on the program?

General **Wagner**. No, sir.

Mr. **Chappell**. Do you suppose somebody could make a call and find that information out on the monthly expenditure rate, how many people?

General **Wagner**. Yes, sir.

Mr. **Chappell**. Why don't we get somebody to get on the telephone and get that information.

[The information follows:]

On the total AFATDS program, as of February 28, 1986, the average monthly expenditure (disbursement) rate of the FY 1986 funds is approximately $200,000. This figure is misleading in that contractual disbursements have a two-three month lag time before they reach the Finance and Accounting records. Of all years that money was disbursed as of February 28, 1986, the monthly average is approximately $2.1 million.

Personnel working on the AFATDS Program in man years:

	A[1]	B[2]	C[3]
Software Development Contract	195		
Project Managers Office			10
Life Cycle Software Engineering Contractor		19	
Life Cycle Software Engineering In-House			6.5
Project Integration Support Contract		33	
AMC Matrix			4.5
Verification and Validation Contract		20	
ILS Support		1	
Cost Estimating Support		3	
Computer Resources Support		1	
Total	195	77	21.0

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[1] A—Magnavox.

[2] B—Other Contracts.

[3] C—Government.

Mr. Chappell. The fiscal year 1986 joint conference report supported completion of the AFATDS concept evaluation phase within the $49.5 million contract ceiling established by the Army.

Assuming the ASARC/DSARC review certifies successful completion of the CEP phase, how does Army plan to use the $40.4 million in RDT&E funds requested in fiscal year 1987?

Get that together while we go up and vote. I will be right back.

[Brief recess.]

Mr. AuCoin [presiding]. We will resume the hearing. Mr. Chappell will be back shortly.

Assuming the ASARC/DSARC review certifies successful completion of the CEP phase, how does the Army plan to use the $40.4 million in RDT&E funds requested in fiscal year 1987?

Dr. Sculley. We will start with the full-scale development software maturation.

Mr. AuCoin. Would you provide for the record a detailed breakdown of planned uses for the requested $40.4 million in fiscal year 1987 as well as the $68 million in fiscal year 1988.

Dr. Sculley. Be happy to, Mr. Chairman.

[The information follows:]

The Army plans to use the $40.4 million RDT&E request for FY 1987 to: complete CEP, demonstrate software transportability, start software maturation and systems integration and procure ACCS hardware for test and integration.

	FY 1987	FY 1988
Government in House	3.6	3.7
Project Integration Support Contract	3.2	3.3
Cost Estimating Support	.3	.3
SW Maturation/System Integration Contract (FSD)	18.0	43.7
Software	(13.5)	(23)
Hardware	(4.5)	(20.7)
Verification and Validation of Software	1.2	1.2
Life Cycle Software Support	1.2	1.4
Other Contracts	.3	1.4
Software Portability Demo	5.2	....
COMSEC Equipment	1.1	....
CEP Costs	.7	....
Communications/message/protocols, software	5.6	12.2
Total	40.4	67.2

Mr. AuCoin. The Army claims that AFATDS software will be transportable and thus reusable by companies other than the current AFATDS prime contractor. In compliance with the Competition in Contracting Act, Army thus plans to complete the $108 million in software planned for fiscal year 1987 and fiscal year 1988, following the CEP.

When will the competitive solicitation be issued?

Dr. Sculley. We will provide the specific date. Certainly during the full-scale development.

General **Wagner**. We feel that it will be transportable. Even if we were tied to one compiler, there are at least four companies that are looking at that now.

[The information follows:]

The current contract was a competitive award. As part of the solicitation options were requested. The current contract contains an option for the next phase of software development. The Army intends to exercise the option to mature the AFATDS software developed in CEP and to transport it to ACCS hardware. The Army plans to compete for further software maturation and integration in FY89 following DT/OT. The AFATDS system integration will use ACCS hardware which will be a competitive award.

Mr. **AuCoin**. Does the estimated $108 million in software already include the anticipated benefits of competition or will this amount be reduced with competition?

Dr. **Sculley**. I think it really does presume competition, yet that we budget to most likely costs

[Additional information follows:]

The $108 million (FY87 and FY88) is not all for software. Requested funding includes integration testing, hardware procurement and other program support costs. This request did not include any competition benefits beyond those included in the original competed contract except for the hardware which will be a competitive ACCS procurement.

Mr. **AuCoin**. When will the required operational capability for AFATDS be approved?

General **Wagner**. I don't understand the question, sir.

Mr. **AuCoin**. When will the required operational capability for AFATDS be approved?

General **Wagner**. We will provide that for the record.

[The information follows:]

The ROC is currently scheduled to be at HQ, Department of the Army for approval by April 1987.

Mr. **AuCoin**. Will the ROC include only software requirements on the assumption that ACCS hardware will meet all the AFATDS objective requirements?

General **Wagner**. We do plan on using the ACCS input to it, but it is primarily a software-driven ROC.

Mr. **AuCoin**. Will the ROC be available for the ASARC/DSARC review——

General **Wagner**. The ROC, as, you know, gives the details of what type of information and what the user expects this system to provide; that is what it will detail and what it must do for the artillery. It is hardware that allows it to meet the functional capability; therefore the ROC will be software-driven.

Mr. **AuCoin**. Will the ROC be available for the ASARC/DSARC review scheduled at the completion of CEP?

General **Wagner**. Yes, sir.

Mr. **AuCoin**. When will full-scale development begin and end?

General **Wagner**. Full-scale development will start some time after March of 1987 when the CEP is scheduled to end. We will then carry that through, go into LRIP and we hope to field the system in fiscal year 1990.

Mr. **AuCoin**. What are the total remaining RDT&E costs for AFATDS up to and including first-article testing? The total remaining RDT&E costs.

General **WAGNER**. About $150 million. That is 1988, 1989 and then 1990.

Mr. **AUCOIN**. How will the congressionally directed upgrading of the fielded systems impact on AFATDS funding?

General **WAGNER**. If it is necessary to upgrade the TACFIRE, that will increase that funding. We are not planning on moving TACFIRE into the reserve components when we come in with AFATDS. It is a system that we would never be able to train them on and keep them trained.

Mr. **AUCOIN**. How much of the RDT&E funds requested for fiscal year 1987 and fiscal year 1988 will be required to implement the plan? Can you provide details on that for the record?

General **WAGNER**. You mean a breakout of it? All of it will be required and we will give you the breakout, yes, sir.

[The information follows:]

The upgrading of the fielded system will not impact the AFATDS funding. The product improvement to TACFIRE, if approved, will be procurement appropriation funded. Software upgrades are OM&A funded and procurement appropriation funded and are programmed. No RDT&E funds are planned for these upgrades. The details of the fielded system upgrade will be provided in the plan now being developed and due to Congress by August 1, 1986. Breakout of funds was provided in previous inserts.

Mr. **AUCOIN**. When will the transportability of AFATDS software be demonstrated and proven?

General **WAGNER**. Primarily during the CEP.

[Additional information follows:]

AFATDS software transportability will be demonstrated immediately following CEP and prior the ASARC/DSARC in 4Q FY 87.

Mr. **AUCOIN**. Do you anticipate difficulty in transporting the software to target processors other than the Motorola 68020?

General **WAGNER**. We would hope that there would be something besides the Motorola 68020. However, in the event that that was the one that we had to start with at the beginning, there are four firms that could compete for the rest of the program using the 68020.

Mr. **AUCOIN**. So you don't anticipate any difficulty——

General **WAGNER**. No, sir.

Mr. **AUCOIN**. In conjunction with the fiscal year 1985 defense appropriation, the Congress directed Army to submit a modified plan on the AFATDS program by April 1, 1985. That plan was finally submitted on September 6, 1985. Subsequently, the fiscal year 1986 joint conference gave Army additional specific guidance and directed that a new plan be submitted by August 1, 1986.

What steps are now being taken to ensure that the August 1 plan will comply fully with that congressional direction?

General **WAGNER**. It is being prepared and we plan on meeting that date for submission to you.

Mr. **AUCOIN**. Will block improvements to the fielded system be included in the Army's August 1st plan?

General **WAGNER**. That is still being considered. I can't tell you now whether or not they will be, sir.

Mr. **AUCOIN**. When does the Army intend to award contracts to meet the light division requirement?

General **Wagner**. We are hoping to test a light-weight TACFIRE. We haven't been able to in the Ninth Division because it failed. However, in our light divisions following our AFATDS approach to improve them incrementally, we are going to put equipment out into the field that will be needed on AFATDS so we don't need additional dollars to do that and we will be moving that into our light divisions in the next two years.

Mr. **AuCoin**. You will be awarding contracts within two years?

General **Wagner**. It is not a contract for this. We are taking the equipment that we have available now and we will put it out there. For example, they have a battery computer system. We are going to issue to the light divisions the fire support team digital message device, and the digital communications terminal DCT.

With this they will have an interim capability that they can operate in the light divisions. That will be used later in the heavy divisions, as well as the light and we don't have to go on a separate contract for that.

Mr. **AuCoin**. What is the ROC for procurement of the light division system?

General **Wagner**. It will be the same ROC with a lesser capability than you have in the heavy divisions. We will just designate what it is. I don't know if a decision has been made at this point whether you have to have a separate ROC for that or not.

Mr. **AuCoin**. Is that in document form, that ROC?

General **Wagner**. It is being prepared. It is not completed.

Mr. **AuCoin**. Would you provide it for the committee?

General **Wagner**. When it is completed, yes, sir.

[The information follows:]

There is no approved light division ROC. The AFATDS ROC will be a total force requirement.

Mr. **AuCoin**. The staff indicates that there is an existing ROC on light divisions. Is that in dispute?

General **Wagner**. I said I don't know if it is approved yet. I will have to find out and if it is we will get it over here.

Mr. **AuCoin**. Why are the fire support team digital message devices not being programmed in the DOD Ada software language?

General **Wagner**. I will have to provide that for the record.

[The information follows:]

The FIST DMD program was initiated prior to the Army's decision to implement Ada for the Army Command and Control System (ACCS). Total FIST DMD requirements are presently being met by funds approved and requested in FY 1984 through FY 1987. Fieldings will be completed by FY 89. Future FIST DMD requirements will be met by ACCS hardware using the Ada language.

Mr. **AuCoin**. If the projected availability of ACCS hardware is as early as 1990, why can't future FIST DMD requirements be met by ACCS hardware instead of buying more FIST DMD's now?

General **Wagner**. If you want to wait on ACCS hardware, you can. I am not sure what you mean by the question, sir.

Mr. **AuCoin**. Would you like me to repeat the question?

General **Wagner**. Yes, sir.

Mr. **AuCoin**. If the projected availability of ACCS hardware is as early as 1990, why can't future FIST DMD requirements be met by ACCS hardware instead of buying more FIST DMD's now?

General WAGNER. Primarily because we are putting those FIST DMD's in our heavy divisions now and will be putting them in the light divisions. We could stop buying them, but it will cut capability if we wait on the ACCS hardware.

Mr. AUCOIN. What does Army plan for AFATDS if the ACCS hardware does not proceed in accordance with its predicted schedule or if ACCS does not become an approved and funded program?

General WAGNER. We will use the available computers that they will be using during their software development at the time.

Mr. AUCOIN. Has the Army conducted a complete cost operational effectiveness analysis on all available AFATDS alternatives? If you haven't, why haven't you?

General WAGNER. I would have to provide that for the record, sir. I don't know the answer to that.

[The information follows:]

The U.S. Army Field Artillery School published an AFATDS COEA on October 11, 1984, which examined the viability of AFATDS as a replacement for TACFIRE to provide automated assistance for accomplishing fire support command, control and coordination functions. The COEA was concerned with differences between the two systems with regard to operational efficiency, performance, training, maintenance, life cycle costs, survivability, transportability, logistics and human factors. Work has begun to update that COEA to support milestone decision review II.

Mr. AUCOIN. Upon completion of the CEP, what percentage of the total AFATDS software functionality will exist in the system?

General WAGNER. We will provide that for the record, sir.

[The information follows:]

At completion of CEP, seventeen of the twenty-six functions required in AFATDS will be completed with the exception of nuclear fire planning. Nine required functions not complete are done in other nodes of ACCS with AFATDS providing interoperability. The required technical fire direction capability is done by the Battery Computer System (BSC), this capability will be included in AFATDS software at the end of BCS life. One of the purposes of CEP is to assist the user in validating doctrine and determining automation requirements. Since detailed requirements have not been finalized, it is difficult to forecast what the total functional software requirements will be. Follow on software development effort is required to develop applications identified in CEP, clean up CEP issues, transport software to ACCS hardware and development of hardware dependent modules such as embedded maintenance/diagnostics and system training.

Mr. AUCOIN. What percentage of the total number of lines of code will have to be written?

General WAGNER. We will provide that.

[The information follows:]

CEP software will represent about 60–65% of AFATDS total.

Mr. CHAPPELL. Please answer any unasked questions for the record.

[CLERK'S NOTE.—Questions submitted for the record and the answers thereto follow:]

QUESTION. How long does the Army plan to keep TACFIRE in the field?

General WAGNER. The Army plans to keep TACFIRE in the field until 1995 at which time it will have been replaced by AFATDS operating on ACCS common hardware.

COMMUNICATIONS CONTROL SYSTEM (CCS)

Question. Last year, Army budget documentation stated "the most immediate threat and shortcoming of TACFIRE is (the need) for a Communications Control System (CCS).

How much was spent on CCS? What has been obtained for the expenditure?

General **Wagner.** From the Concept Evaluation Program investment of $12.3 million, we learned enough to avoid the planned subsequent $200 million full-scale development and production costs associated with the CCS as a separate box. The major communication problem facing TACFIRE is the build up of messges during a high intensity, target rich scenario. The cause of the build up is the centralized architecture of TACFIRE not the communications. The only solution is to increase the processing resources with a decentralized architecture. The CCS CEP validated the AFATDS requirement for a decentralized architecture. The Army received six CCS prototypes with programmable modems. These CCS prototypes will be used in the AFATDS CEP which starts in September 1986 and where practical the CCS documented Ada software will be incorporated into the AFATDS software. The CCS Concept Evaluation Program Test Driver hardware and software are being upgraded for use in the AFATDS Concept Evaluation Program testbed.

Question. The Army's Descriptive Summary for AFATDS for FY 1987 includes a very long listing of TACFIRE's problems and deficiencies, and concludes that the only viable approach is to develop a new system. This committee pointed out the very same problems and deficiencies back in 1979 and 1980, only to be told by the Army that TACFIRE was essential, and that continued procurement and fielding was vital.

What contribution is TACFIRE now making to operations in the field?

General **Wagner.** The TACFIRE system is the Army's first generation of the fire support command and control automation which replaced a manual system. TACFIRE provides a significant improvement in the execution of those operational functions that TACFIRE was designed to do, even with all of the identified shortcomings. TACFIRE allows the performance of simultaneous operations to a degree that can not be achieved without automation. We can attack more targets faster and with greater accuracy. Coupled with the Battery Computer System individual gun firing data gives better effect on the target. TACFIRE speeds up fire support coordination and is more accurate in ensuring that fire coordination/limiting measures are not violated. TACFIRE greatly reduces the time to develop fire support plans and schedules of fire and getting that information to the necessary subscribers. Our experience with TACFIRE has aided greatly in defining the requirements for AFATDS.

Question. If a major conflict were to occur, how well do you expect TACFIRE would perform?

General **Wagner.** TACFIRE has been very reliable. TACFIRE will perform well so long as it survives. Because of TACFIRE's centralized architecture which creates a unique electronic signature, TACFIRE is vulnerable.

QUESTION. In particular, what would be the result in a major conflict of TACFIRE's communications shortcoming?

General WAGNER. During surge and because of enemy electronic countermeasure (ECM), throughput will be reduced and some messages will be lost. The problem in a major conflict of message build up in a centralized architecture such as TACFIRE continues to be a vulnerability separate from the communications ECM issue. To provide for a surge capability and to enhance survivability the Army must use a decentralized architecture. AFATDS is a decentralized architecture.

LIGHT DIVISION CAPABILITY

QUESTION. Last year, this committee instructed the Army to realign its plans so as to allow near-term fielding of equipment for the light divisions. To accomplish this, $25.6 million of FY 1986 procurement funds were provided. What has the Army done to comply with this directive?

General WAGNER. The Army submitted our plan for the light divisions to the committee on September 6, 1985. This plan provides for near-term improvements to the light division fire support capability by fielding existing pieces of equipment in FY 1986 and FY 1987. The Battery Computer System (BCS) has been fielded, the Fire Support Team Digital Message Device (FIST DMD) is scheduled for fielding in FY 1986 once FAT is completed.

QUESTION. What procurement actions have taken place or are planned?

General WAGNER. The Army has initiated procurement for 270 Digital Communications Terminals (DCT) through the US Navy to meet near term light division requirements. This is a below threshold reprogramming. The $25.6 million provided by the committee in FY 1986 can not be obligated until the funds are authorized by Congress and the Army's revised plan is approved by the Appropriations Committees of the House and Senate.

FIRE SUPPORT PLAN

QUESTION. The committee also instructed the Army to revise its plans for acquiring equipment for the heavy divisions. What is the status of that effort?

General WAGNER. The Army is preparing the directed plan. This plan will address all fielded and planned fire support C^2 systems and planned enhancements. This plan will be submitted to Congress by August 1, 1986.

QUESTION. Is it your belief that Army plans are now in consonance with committee directives.

General WAGNER. Yes. The September 6, 1985 addressed only the light division fire support enhancement. The revised plan directed by the FY 1986 Joint Conference will address the fielded systems in the heavy divisions.

[CLERK'S NOTE.—End of questions submitted for the record.]

FIBER OPTICS GUIDANCE (FOG-M)

[Brief recess.]

Mr. AuCoin. The Army has been pursuing development of the technology of fiber optics guidance for which $5.0 million are requested in fiscal year 1987. This technology has been said to have potential in an anti-armor role. More recently, its proponents have been advocating the use of FOG technology in an anti-helicopter role.

Last year the committee agreed to provide the budget request for FOG of $6.5 million, but stated that it would provide no more funds in future years without further concrete justification.

When may we expect to receive that justification?

General Wagner. Sir, the ROC is being prepared on that program right now. The ROC that will be prepared will be for the nonline of sight system for air defense. We will combine the $5 million that we had in the anti-tank role with additional dollars that we are asking for in this year's budget in our air defense program to drive that forward.

We have flown that system against two helicopters recently. In November FOG–M flew 9 km and hit a Cobra helicopter that was on the ground with a rotating rotor. Just last month we flew it against a UH–1 drone helicopter moving at 75 knots, and drove it right through the top of it. We feel that it has a high payoff and is one of the major initiatives in our forward air defense program. It is the follow-on and replacement for the capability we lost when we lost the DIVAD.

Mr. AuCoin. I didn't understand when you indicated you expected the committee to be able to receive the justification we asked for.

Dr. Sculley. The Commanding General at our Air Defense School and Center on 27 February provided what we feel was a report to the authorizing subcommittees and we would be happy to provide that same justification to the Subcommittee on Defense.

Mr. AuCoin. This committee has a standing request of the Army.

Dr. Sculley. Yes, and we will be happy to provide that.

Mr. AuCoin. Why hasn't it been submitted to us up to this point?

Dr. Sculley. That, I can't answer, but it will be provided without delay.

Mr. AuCoin. General, do you know?

General Wagner. It was asked for as an anti-armor system, sir. We didn't carry it forward as an anti-armor system because we have not started the follow-on to TOW yet where it may be a candidate in the future. However, as we looked at our problems in air defense, it appeared this might have a high payoff there. We have changed the approach and we are developing the program along that line. That we will submit to you

[Clerk's note.—This subject was addressed in responses to questions on Air Defense Alternatives. See pages 66 to 72.]

Mr. AuCoin. How committed would you say the Army is to this program?

General Wagner. I would say strongly committed.

Mr. AuCoin. The fiscal year 1986 budget estimated that the funding requirement in fiscal year 1987 for FOG would be $1.6 million. Why has that amount tripled to $5 million?

General **Wagner**. Sir, with $5 million you could have a demonstration. We are looking at putting the FOG-M design package into a competitive environment. We will pull the nearly complete design package it out of the missile command, and go on the street with it. If we accelerate the program so that we could field it in the 1988 to 1989 time frame, we need to move development funding up to probably the $90 million level in 1987.

Mr. **AuCoin**. Mr. McDade.

ARMY TACTICAL MISSILE SYSTEM (ATACMS)

Mr. **McDade**. Let's talk about the tactical missile system.

You are requesting $88.2 million to continue development of the Army Tactical Missile System. The intent is to develop a tactical ballistic missile for attacking targets at long range.

Last year the Army projected a fiscal year 1987 requirement of $162.8 million for ATACMS. Approximately one-half that amount, $88.2 million, is now actually requested. Army documentation states that the request derives from "a funding decrease of $162.8 million to support higher Army requirements" and "an increase of $90 million as a result of an out-of-court settlement between DA and OSD."

What is that all about? Did OSD zero the program?

Dr. **Sculley**. They did not. There was some misunderstanding in Defense because of a combined approach that we have between the Army Tactical Missile System and some joint programs that are special access in nature and it was on that basis I think that there was a misunderstanding if those moneys were removed by Defense, they were in fact, I think rather quickly restored and we had a successful DSARC, too, with Defense last month and feel that the Army Tactical Missile program is on track and we expect selection of a contractor later this month, sir.

[Additional information follows:]

OSD did not zero the program. In the "out of court" settlement OSD supported the Army's recommended restoration of the program and corresponding proposed TOA changes. OSD did not state reasons for its support of the Army position.

Mr. **McDade**. What do you exactly mean when you talk about an out-of-court settlement between the Department of the Army and the ——

General **Wagner**. Sir, when you get into programming and budgeting in our five-year programs, you initially put in your program. There are programs that cannot be afforded or are not fully funded. Then the services go before the Defense Resources Board and the board decides what they are going to do. If it is like a program is very high priority we may be able to pick it up before it has to go to the level of the Deputy Secretary of Defense for a decision. Our people meet with the staff officers in OSD and we come to what we call an out-of-court settlement on how much money will be put on that program. That is what happened.

Mr. **McDade**. That means there is concern in some places whether ATACMS is affordable.

General **Wagner**. There was concern last summer whether it was affordable. When we looked at the payoff, we decided it was affordable. That is the reason we went for the out-of-court and we have just gone for an ASARC and DSARC so we can go on contract.

Mr. McDade. Will ATACMS be used elsewhere than in NATO?

General Wagner. It can be used in other parts of the world, sir, if we were to get into a heavy land battle such as in Southwest Asia, but its principal payoff will be against the Soviet forces in Central Europe.

Mr. McDade. How was the figure of $90 million for fiscal year 1987 derived? What relationship does it have to the work which was originally proposed for fiscal year 1987 funding?

General Wagner. The program slipped and we are taking the dollars that we had in 1986 and 1987, and rolling them together to get the start, that will go on contract later this year.

[Additional information follows:]

The FY 1987 request of approximately $90M was based on government cost estimates for the program assuming full scale development contract award in the second quarter of FY 1986. The budget request and the corresponding work to be done are consistent with the program approved by the previously conducted ASARC and DSARC.

Mr. McDade. Did you have technical problems?

Dr. Sculley. No, sir. We work literally over time to ensure we had competition in this phase. For a period it appeared we would have only a single team interested in bidding and at least now that we have a competitive development program and a competitive fixed-price, not-to-exceed, production option.

Mr. McDade. If ATACMS were cancelled, what assets would the Army use to carry out the equivalent mission?

General Wagner. We don't have assets now and I will have to discuss that in another session as special access.

[Additional information follows:]

The Army has no system which could be used to provide conventional fires at operational depths consistent with ATACMS. The Lance conventional missile has less than half the range and one-third the accuracy of ATACMS. The preponderance of second echelon Soviet targets are positioned beyond the range of Lance. Without ATACMS the Army would be required to wait until Soviet follow-on forces closed within range of Lance and close support systems prior to engagement. Those targets (e.g. CPs, Helo bases) that would not traditionally close on the line of contact and would remain out of Lance range and continue to function unaffected by indirect Army fires.

Mr. McDade. Describe the ATACMS system to me.

General Wagner. The ATACMS system will be fired from our MLRS launcher. The only difference will be instead of putting a packet of multiple launch rockets up here, six of them, we will put a single missile in a container. The outsider looking at it on the ground won't know the difference.

We will mount two of these missiles on the MLRS launcher.

Mr. McDade. The MLRS wasn't designed for this particular weapon nor the weapon for that launcher. Is that any problem, are there design problems or anything that is occurring that we need to know about?

General Wagner. None that we see. There are very minor software changes in the fire control computer that have to be made to fire this particular system, but it is a simple fix.

Mr. McDade. No severe technical problems?

Dr. SCULLEY. Not that we are aware of. I did, in fact, authorize a sole-source systems integration contract to Vought regardless of the winner. They have been a reliable producer in the MLRS program who I think are best qualified as the integrator and we do not anticipate problems.

Mr. McDADE. Thank you, Mr. Chairman.

AIR DEFENSE ALTERNATIVES

Mr. AuCOIN. I want to ask some questions on air defense alternatives.

The Army is requesting $20.6 million to pursue the Line of Sight Air Defense System-Heavy. This project is intended to select an off-the-shelf system as a replacement for DIVAD.

The Congress provided $41 million of fiscal year 1986 funds for evaluation of off-the-shelf alternatives.

Why does the fiscal year 1986 column of the fiscal year 1987 budget show only $10.8 million?

General WAGNER. That is probably the difference, and I would have to provide that for the record. It is probably the difference between appropriated and not authorized. That may be the difference.

Dr. SCULLEY. We will have to provide that for the record. I don't know that, Mr. Chairman.

General WAGNER. That could be the difference because we haven't gotten all those dollars yet, so I will have to check that in 1986. Most of the dollars we got on the air defense system because the DIVAD was killed after the Authorization Act came in were appropriated and not authorized. The Authorization Committees have not met on that yet.

[The information follows:]

$176 million, RDTE, was requested by the Army. Congress appropriated $41 million. These funds were then divided between forward area air defense C^3I sensors, non-line of sight, and line of sight forward, air defense systems. LOS-F-H's portion is $10.8 million.

Mr. AuCOIN. I am told the Congress appropriated the $41 million.

General WAGNER. Appropriated is correct, sir.

Mr. AuCOIN. So then why does the 1986 column of the 1987 budget show only $10.8 million?

General WAGNER. I believe it is because it probably isn't included there if it wasn't authorized, but I will have to check that and provide it.

Mr. AuCOIN. What specific work is being done in fiscal year 1986 on this evaluation?

General WAGNER. In 1987, we will go on the street with an RFP (Request for Proposal). We have gone out already with what we call a RFI, request for information, to look at what is available in the marketplace to solve this problem for our line of sight system. We would hope to have a combination gun missile system. Now this doesn't have to be on the same carrier. It could be, however. If it was, we would call it a hybrid system.

So we are letting industry come back to us and say, "This is what is available today to solve your problem." It could be a mix of guns and missiles or all gun or all missiles.

As I say, we are pushing for the mix.

Mr. AuCoin. Tell the committee what specific work is to be done with fiscal year 1987 funds for this program.

General Wagner. In 1987 the program on this particular piece we will have demonstrations of the systems and will actually test them during that period. That will get started in 1987.

Mr. AuCoin. What specific alternatives does the Army expect to examine?

General Wagner. We expect to examine mixes of missiles and guns.

Mr. AuCoin. When do you expect the selection to be made?

General Wagner. We would hope to have the—we want to release the RFP within the next month or so. I hope to get those aboard and demonstrate them this year. We would like to select a winner in 1987.

Mr. AuCoin. When would that put the equipment in the field?

General Wagner. If it came off according to schedule, and it depends a lot on the system selected, it looks like calendar year 1989.

NLOS AIR DEFENSE SYSTEM

Mr. AuCoin. The Army is requesting $83.3 million for development of a Non-Line of Sight Air Defense System. The stated purpose is to attack helicopters which are hidden behind terrain features. This evidently is a new start, not having previously been announced to the Congress.

The fiscal year 1986 column of the fiscal year 1987 budget shows $19.7 million for this NLOS system. Where did the funds come from?

General Wagner. They came from the release of the prior year Sergeant York's funds. We need the funds authorized for a release to help fund that program. That is part of the $41 million. This committee went along with in appropriating last year.

Mr. AuCoin. Evidently the Army views fiber optics guidance as the leading candidate for this new start.

Is that correct?

General Wagner. Yes, sir. We will look at other possibilities such as a ground-launched AMRAAM, but the fiber optic guided missile system appears to us right now to have the highest payoff and probably the simplest. I have got a quick tape of the FOG–M to show you.

In fact, we tested this down at Redstone Arsenal.

Mr. AuCoin. This is the fiber optics——

[Tape shown.]

General Wagner. The fiber optic guided missile tested at MICOM. The missile is coming out vertically launched. You can see the fins popping out. There is a trailing fiber optic cable that comes out of the rear of this with a range of up to 10 kilometers. It is flying after a UH–1 drone helicopter.

Now you can see him lock on the target with the auto tracker. This is a Specialist 4th Class. He had three weeks of training on the FOG-M system.

He is tracking it manually at this point. This test firing is just a demonstration now. This is not something that is ready to go into production.

He will get away from the target in a minute and he has to come back on. Now it has just locked on, it locks on automatically. You can see it hit the target.

You were looking through the front end of the missile as it hit. That is not a fully operational test because the gunner knew the flight path of the helicopter and knew where it was coming from due to the small range used. It was a demonstration intended only to prove whether or not we could hit a flying helicopter.

Mr. AuCoin. You mentioned one possible candidate. What are the other major——

General. Wagner. Those are the two major ones we know of right now.

Mr. AuCoin. As noted earlier, fiber optics guidance, this committee has stated in its fiscal year 1986 report that no more funds would be available for FOG without further concrete justification. Absent the submission of that justification to the committee, how do you propose to proceed?

General Wagner. A ROC is being reviewed for approval now. It is at headquarters DA for approval. The final acquisition plan is going through Army Materiel Command for approval and we will provide those to this committee so we can get the go-ahead on the program.

Mr. AuCoin. The NLOS system is projected as a new start using fiscal year 1986 funds. The Army says that development will cost $517 million, with about half that total to be spent after fiscal year 1988. Nevertheless, the Army also says that procurement of NLOS system will begin in fiscal year 1988.

Has the Army drawn any conclusions about such concurrency, which also existed in development, testing and procurement of DIVAD?

General Wagner. Sir, this is not a DIVAD. First of all, FOG-M is a relatively simple system that we have brought along through technology. Procurement would start in FY 88 for the simple, day only system. We are hiring contractors with the 1987 dollars—excuse me, the 1986 dollars to build hard tooled prototypoes for extensive user testing. The 1987 dollars will continue development and provide almost a complete technical data package. Then the Army could go out for competition bring aboard, hopefully, at least two contractors who would complete development of it and then go into production. Development dollars would exist past FY 88 for the pre-planned product improvement.

We feel it is a relatively low-risk program.

Mr. AuCoin. DIVAD had a great deal of concurrence, you agree?

General Wagner. Yes, sir.

Mr. AuCoin. Isn't the same degree of concurrency evident in the NLOS system?

General WAGNER. If we use a different testing technique, use more prototype systems of them and collecting data we think we can pull it off.

If we can't, this is like the other program we discussed earlier. We will not lock on a date, but on meeting a goal before we go ahead with the program.

Mr. AuCoin. How did you arrive at the estimate of the cost of the development?

General WAGNER. It was developed by the Army Materiel Command.

Mr. AuCoin. Why does the Army project entering procurement of a new system which uses new technology only two years after the start of development?

General WAGNER. Because it has been in essentially what you would normally call advanced development at the Missile Command for some number of years and they have flown a number of them.

Mr. AuCoin. How many years?

General WAGNER. They have probably been working on it four or five years or more. Mr. Seraphin knows the specific number. I don't know how long they have been working on it.

Mr. AuCoin. Please respond to the questions on Air Defense Alternatives for the record. We need to get some clarifying answers.

[CLERK'S NOTE.—Questions submitted for the record and the answers thereto follow:]

AIR DEFENSE ALTERNATIVES

QUESTION. The Congress provided $41 million of FY86 funds for evaluation of off-the-shelf alternatives.

What specific work is being done in FY 1986 on this evaluation,

General WAGNER. The Army Materiel Command is analyzing the Request for Information (RFI) data received from industry to determine whether a demonstation will be required this year. Analysis can only go so far because of the appropriated but not authorized $10.8 million. We expect to overcome this problem shortly.

QUESTION. How does the reduction in FY 1986 funding correlate with the stated urgency for finding a replacement for DIVAD?

General WAGNER. Due to the reduction from $176M to $41M RDTE, the Army had to prioritize its FAAD RDTE requirements and reprogram, among others, Air-to-Air STINGER for the OH-58 C/D and an additional $6.75 million for LOS-F-H.

QUESTION. What specific work is to be done with FY 1987 funds?

General WAGNER. The operational demonstration and the Source Selection Evaluation Board (SSEB),

QUESTION. What specific alternatives does the Army expect to examine?

General WAGNER. We will examine all entrant's in three possible categories: missile system with combined arms guns, gun/missile system on a single vehicle, and gun missile on separate vehicles. The cost and operational effectiveness analysis (COEA) will allow us to narrow down to a specific class of weapon.

QUESTION. When will a selection be made?

General WAGNER. We expect to sign the production contract in June 1987.

QUESTION. When will equipment start reaching the field?

General WAGNER. We expect the first unit equipped (FUE) date to be June 1989.

QUESTION. The FY 1986 column of the FY 1987 budget shows $19.7 million for this NLOS System. Where did those funds come from?

General WAGNER. The $19.7 million is part of the $41 million available from the SGT YORK program termination. $41 million was made available for air defense alternative testing and we need $19.7 million to test NLOS.

QUESTION. The Army is requesting $83.3 million for development on Non Line of Sight Air Defense System. Evidently the Army views the Fiber Optic Guided Missile (FOG–M) as the leading candidate. Is that correct?

General WAGNER. Yes. When the Army conducted its study of the forward area of the battlefield in the wake of the SGT YORK termination, it exmained any weapon that could have an application in defeating hovering helicopters standing off from our maneuvering forces and using terrain to be hidden from view. The FOG–M was found to be the most promising weapon screened for that non line of sight mission.

QUESTION. What are the other candidates for the Non Line of Sight Air Defense System besides the Fiber Optic Guided-Missile (FOG–M)?

General WAGNER. The only alternative to FOG–M under review is the ground launched version of the Advance Medium Range Air-to-Air Missile (AMRAAM). The evaluation of AMRAAM will be conducted this year.

No other alternative is under review at this time but we are looking at whether any systems already in the combined arms or in development may have an interim capability to meet this mission.

QUESTION. As noted above under the heading "Fiber Optic Guidance," this Committee stated in its FY 1986 report that no more funds would be provided for FOG–M without further concrete justification. Absent the submission of that justification to the committee, how do you suppose to proceed?

General WAGNER. After the DIVAD termination the Army formed the Forward Area Air Defense Working Group (FAAD–WG) to develop a program to provide adequate air defense for our forward forces. The Army briefed the program to the Secretary of Defense in January 1986 and the Program was approved. A key component of the program is the Non Line of Sight (NLOS) Air Defense System. NLOS is needed to effectively engage hovering or slow moving helicopters standing off beyond the range of our current forward forces or masked by terrain from engagement of the forward forces. The NLOS component will be deployed in defilade near the Forward Line of Troops, masked from visual detection by the enemy. FOG–M is one of the leading candidates for NLOS. To find out more about FOG–M, the Army intends to buy a platoon of FOG–M weapons and test them in an operational environment. The results of the testing coupled with analysis results will allow the Army to ensure the design fully meets the projected threat in a variety of battlefield situations. Our FY 87 budget request of $83.3 million in RDTE is to evaluate NLOS alternatives, enhance the basic FOG–M design, and to test FOG–M in an operational environment. The FAAD–WG report has been published and the NLOS program initiated. The Required Operational Requirement (ROC) is ready for approval. A Cost and Operational Effectiveness Analysis (COEA) has been started and is scheduled for completion in January 1987. The Acquisition Strategy for NLOS is in staffing now. MG Infante, the Commanding General of the Air Defense Artillery Center and School presented the FAAD program to a House Armed Services Committee Subcommittee on Procurement and Military Nuclear Systems on 27 February 1986. The Army is prepared to provide additional justification upon request.

Question. Has the Army drawn any conclusions about the concurrency which existed in development, testing and procurement of DIVAD?

General **Wagner**. The major lesson learned from the use of concurrency in the Division Air Defense (DIVAD) Gun program is that concurrency coupled with a hands-off approach does not appear to be well suited for the acquisition of complex systems. These systems generally experience engineering development and system integration problems that either hinder or delay a smooth transition into production. Concurrent testing needs to be well structured, to include providing adequate time to conduct full operational testing prior to the full scale production decision. It should not be concluded from the DIVAD experience that concurrency in and of itself is bad. Other weapon systems not as complex as DIVAD have successfully used concurrency in their acquisition strategy (e.g., the Multiple Launch Rocket System (MLRS)).

Question. The NLOS System is projected as a new start using FY 86 funds. The Army says that development will cost $517 million, with about half that total to be spent after FY 88. Nevertheless, the Army also says that procurement of NLOS System will begin in FY 88. Is the NLOS System headed down the same path the DIVAD Gun followed in regard to concurrency?

General **Wagner**. No. While NLOS is a new start in FY86, the FOG–M candidate, for example, has been in development for some time. FOG–M reached the concept development stage in 1981 capitalizing on years of fiber optic development by private industry. The first unguided aero-propulsion flights began in May 1983, and the first guided flight in April 1984 covered five kilometers. The first test of the missile against a helicopter was in November 1985 when a nine kilometer shot scored a direct hit on a Cobra helicopter positioned on the ground. In February 1986 the FOG–M scored a direct hit on a flying drone UH–1 helicopter which was traveling at approximately 60 knots at 75 feet in altitude. We can already mount a FOG–M system on a High Mobility Multi-purpose Wheeled Vehicle (HMMWV). This year we are buying hard tooled hardware prototypes for a user test next year. So we already know a great deal about this system and plan to test it fully before production. We would initially field a day only system. We know we can do that because the system has already matured to the point where a HMMWV configuration is available for test. We only need a day system upon fielding because that will be the threat capability then. But as the threat grows, FOG–M would have to grow. That is why we show development continuing past production. We would field a day only system and then follow with a very realistic Pre-planned Product Improvement Program to get a night capability and extended range. So development dollars are needed now to test and field a day capability and development dollars will continue to develop a tracked heavy system and a program to obtain night capability with extended range.

QUESTION. How was the estimate of cost of development derived?

General WAGNER. The Materiel Command developed a NLOS cost estimate based upon engineering data and analysis in support of the Forward Area Air Defense Working Group Study. The estimate will be continually updated during the development process.

QUESTION. Why does the Army project entering procurement of a new system which uses new technology only two years after the start of development.

General WAGNER. The NLOS program is indeed new. However, the systems under study, FOG–M and AMRAAM, are not. The Army has been developing the FOG–M since it reached the concept development stage in 1981. This capitalized on years of development of fiber optics by private industry. Unguided aero-propulsion flights began in May 1983. The first guided flight in April 1984 covered five kilometers. The first test of the missile against a helicopter was in November 1985 when a nine kilometer shot scored a direct hit on a Cobra positioned on the ground. In February 1986 the FOG–M scored a direct hit on a flying drone UH–1 helicopter which was traveling at approximately 60 knots at 75 feet in altitude. So, in reality, if the Army chooses FOG–M for the NLOS mission it will have been in development for approximately eight years before going into limited production. The need to field a system soon to counter a threat that is to attack our forward forces with immunity drove us to find systems that were well along in development.

[CLERK'S NOTE.—End of questions submitted for the record.]

Mr. AUCOIN. Mr. Dicks, Mr. Wilson, and Mr. Young have some questions they would like you to answer for the record.

AVENGER

[CLERK'S NOTE.—Questions submitted by Mr. Dicks and the answers thereto follow:]

QUESTION. The FY 1986 Continuing Resolution provided $41 million in research and development funds for examination of alternatives to DIVAD. Information provided by the Army indicated that evaluation of off the shelf alternatives would take place and the conferees agreed that such an evaluation should take place as quickly as possible. What is the status of that evaluation?

General WAGNER. It will be conducted if need be in the July to December 1986 time frame as delineated in the Request for Information (RFI) released to industry on 24 January 1986.

QUESTION. How will funds be requested in FY 1987 to follow through on the results of this review?

General **Wagner**. $20.6 million RDTE have been requested for FY 87 to follow through on the FY 86 start.

Question. One of the off-the-shelf systems being examined is the Avenger, which consists of a rotating turret equipped with STINGER missiles mounted on a HMMWV. What missions is this system being considered to fulfill?

General **Wagner**. The Avenger system is not associated with the $41 million in R&D funding for examinations of alternatives to DIVAD. The Avenger has been under consideration by the Army for the past 1½ years as a means of improving the man-machine interface with man-portable STINGER. The Army is now planning to compete the Pedestal Mounted STINGER (PMS) program (now Line of Sight—Rear) as directed by Congress in 1985. The Avenger system is expected to be one of the competitors. The necessary funding for this effort, both RDTE and Procurement, is in the STINGER program.

Question. What is the status of the specific examination of this alternative?

General **Wagner**. MICOM has issued a draft RFP for a competitive evaluation and 3 years of production procurement. Contractor comments and questions are due to be received by the Government on 28 March 1986. These comments will be reviewed and appropriate comments will be located in the final Request for Proposal (RFP) due to be released to industry on 21 April 1986. A competitive evaluation will be conducted during August to November 1986. A production contract will be issued in February 1987 to the winning contractor.

Question. What cost and time to deployment advantages could such a system offer?

General **Wagner**. The Army plans to procure the Line of Sight—Rear system as a non-developmental item. This procurement approach will save a full engineering development and approximately 4 years of time. The first units are scheduled to be fielded in FY88.

[Clerk's note.—End of questions submitted by Mr. Dicks.]

JOINT SERVICE SEEKER

[Clerk's note.—Questions submitted by Mr. Wilson and the answers thereto follow:]

Question. Has the Army requested funds for FY 87 for the Joint Service Seeker?

General **Wagner**. The Army has not requested FY 1987 funds for the Joint Service Imaging Infrared (IIR) Seeker because of language in the FY 1986 Joint Conference on Appropriations that specifically denied funding for Joint Service Seeker.

Question. What is the Joint Service Seeker?

General **Wagner**. The purpose of the IIR program is to develop long wavelength infrared focal plane array (FPA) seeker technology to provide a simpler, lower cost IIR seeker approach. This is the only DOD 6.3A program to transition the FPA technology to seeker hardware development for government evaluation. This effort will establish IIR seeker technology and maximum commonality for application to existing and developing systems. Competitive technology developments will provide DOD with the lowest cost IIR seeker for tactical applications. The Army has the lead role in this development per the 1984 Memorandum of Agreement signed by the three Services.

QUESTION. What systems will it be used on?

General WAGNER. For systems planned or under development, IIR has potential for use on Hellfire Fire and Forget, Fiber Optic Guided Missile (FOG–M), and Advanced Anti-Armor Weapons System Medium (AAWS–M) and Heavy (AAWS–H). IIR is the primary technology planned for FOG–M in the Anti-Armor role and in Forward Area Air Defense System (FAADS).

QUESTION. What is the impact of not having 86 funds?

General WAGNER. The contract with Ford Aerospace and Texas Instruments will be terminated. To date, the Army has $10 million in sunk cost and the two prime contractors have essentially matched Army expenditures dollar for dollar. Additionally, because of Army interest and priority, Hughes Aircraft and McDonnell Douglas/Honeywell continued development of the IIR seeker on a "no cost basis" with the government. Their intention was to participate in evaluations for future contracts. The impact of not having FY 1986 funds will preclude the scheduled delivery of seekers for government evaluation in FY 1986, and deters industry investments in IIR technology.

QUESTION. What happened to the 86 funds?

General WAGNER. FY 86 funds were authorized, but not appropriated.

QUESTION. Does the Army consider this R&D item a high priority?

General WAGNER. This technology is a high priority because of the imaging capability that provides excellent target resolution and aim point selection. The development of man-in-the-loop systems, such as the Fiber Optic Guided Missile, requires an imaging seeker that allows the operator to acquire, identify, and engage targets at night and in adverse battlefield environments. The IIR technology has significant potential for use on other systems as previously mentioned.

(CLERK'S NOTE.—End of questions submitted by Mr. Wilson.]

AIR DEFENSE ALTERNATIVES

[CLERK'S NOTE.—Questions submitted by Mr. Young and the answers thereto follow:]

QUESTION. Dr. Sculley, for years the Army has testified to the need for a new Air Defense weapon. For years, we appropriated money for a new Air Defense Weapon, the most recent—the DIVAD. Now that the Secretary of Defense has cancelled that program where do we stand? What alternatives are you looking at?

Dr. SCULLEY. At the direction of the Secretary of Defense, the Army undertook the task to develop solutions to the critical shortfall in air defense for our divisional forward maneuver forces created by the DIVAD program termination. The emerging helicopter threat with the growing capability to stand off outside current air defense weapons ranges and engage friendly forces was a major reason for DIVAD's failure. With the fielding in the near future of a new class of Soviet standoff helicopter with more range capable and lethal weapons, the urgency of providing quick solutions to the requirement is more significant. The Secretary of the Army directed Foward Area Air Defense Working Group has just completed a detailed analysis of the deficiencies and provided a new air defense program to the Secretary of Defense to meet the requirement. The Secretary approved the program in principle on 8 January 1986. This Forward Area Air Defense (FAAD) program consists of the following essential elements:

A robust command, control and intelligence system which alerts both combined arms and air defense artillery weapons of impending air attack using a combination of airborne and ground sensors and providing aircraft identification for those weapons.

A non-line-of-sight weapon which provides the capability to effectively defeat the new "over the hill/out of sight" stand-off helicopter.

A forward line-of-sight system will be employed in the close combat zone of our divisions. There are two variants, a tracked variant for the heavy divisions and a wheeled variant for the light division the variants will be designed to kill and suppress enemy fixed wing aircraft and exposed helicopters. They will also be capable of operating at night and engaging helicopters in ground clutter. A gun/missile mix is required for the variants as it capitalizes on the strengths of both weapon types.

A rear line-of-sight system which enhances STINGER by placing up to eight missiles, with added sensors and fire control and a pedestal mount, on a HMMWV vehicle.

A combined arms enhancement program which improves the Bradley Fighting Vehicles' air defense capability, accelerates the air-to-air STINGER on the OH-58 helicopter, develops air-to-air capability for the AH-64, AH-1 and UH-60 and investigates smart munitions for anti-helicopter use by our tanks.

It is important to understand that the Forward Area Air Defense (FAAD) program is a system of major subsystems. Only the nonline of sight system is a new requirement. The other subsystems were already in the Army budget. The FAAD program has integrated these subsystems together to optimize the contribution of each in meeting the growing air threat facing or divisional forces.

SOVIET THREAT

QUESTION. Is the threat from the Soviets still as severe? (Referring to cancellation of DIVAD).

General WAGNER. The primary threat related reason for cancellation of DIVAD was the postulation of an increased ability for Soviet helicopters to stand off beyond the range of the DIVAD and engage targets with increasingly sophisticated munitions. It is currently postulated that the Soviets may use any of three different tactics to engage foward maneuver forces with helicopters by 1995. The first is a standard run-in tactic using guns, rockets and hard bombs. This tactic makes the helicopter vulnerable to many systems on the battlefield including small arms. The second tactic is to stand-off with line of sight to the target but at extended ranges, ———. In addition to an increasing threat by helicopters, the fixed wing threat continues to increase qualitatively and the threat to a

DIVAD follow-on will continue to increase just as it has for all of the forward maneuver forces.

ARMY TACTICAL MISSILE SYSTEM

QUESTION: As you know, it was a real battle here in Congress last year to provide the funding for the Army ATACMS program. At that time, you said it was one of the Army's highest priorities. Is that still the case?

General **WAGNER**. Army TACMS remains one of the Army's highest priority programs. We consider this program in the "must fund" category in that it will provide the Army with an urgently required effective conventional deep strike capability.

QUESTION. Can you bring us up to date on that program?

General **WAGNER**. The Army TACMS program has undergone all the required internal Army and Department of Defense reviews and has been approved for entery into Full Scale Development (FSD). We expect a competitive award of the full scale development contract in late March or early April of this year.

UNMANNED VEHICLES

QUESTION. Dr. Sculley, we are aware of the requirement to perform the mission of lethal attack of emitters with unmanned air vehicles compatable with existing force structure. To date, we have seen no activity. How is the program coming and why have we seen no progress?

Dr. **SCULLEY**. The information requested is classified and will be provided to Mr. Young in the form of a briefing at his convenience.

[CLERK'S NOTE.—End of questions submitted by Mr. Young.]

Mr. **AUCOIN**. Also, please answer the balance of the committee questions for the record.

[CLERK'S NOTE.—Questions submitted for the record and the answers thereto follow:]

HELLFIRE ON BLACK HAWK

QUESTION. The Fiscal Year 1986 RDT&E appropriation provided $17 million to acquire a capability to launch Hellfire missiles from Black Hawk helicopters. Those funds were specified as being for completion of development activities and to initiate low rate initial production.

In its fiscal year 1986 report, this Committee directed the Army to include funds for subsequent procurement in the Fiscal Year 1987 Budget.

Why have no fiscal year 1987 funds been requested for this purpose?

General **WAGNER**. RDT&E funds provided in fiscal year 1986 are adequate to complete qualification for this system. Since the production contract award is not anticipated until calendar year 1988, procurement funds will not be required until fiscal year 1988. The Black Hawk project manager requested funds in the Fiscal Year 1987 President's Budget beginning in fiscal year 1988 to procure Hellfire systems.

Question. Why has the Army chosen to ignore the directive of this Committee?

General Wagner. The Army has not ignored the directive. RDT&E funds provided in fiscal year 1986 are adequate to complete qualification for this system. Since the production contract award is not anticipated until calendar year 1988, procurement funds will not be required until fiscal year 1988. The Black Hawk project manager requested funds in the Fiscal Year 1987 President's Budget beginning in fiscal year 1988 to procure Hellfire systems.

Question. When will development activities be completed?

General Wagner. Key milestones are:

Initial Dev Contract Award	September 1984.
Contractor Firing Demo (successful launch of 6 missiles).	December 1985.
DT/OT II	1–2 Qtr FY 1987.
IPR	4th Qtr FY 1987.
Competitive Contract Award	3rd Qtr FY 1988.
Initial Deliveries	2nd Qtr FY 1990.

Question. When will low rate initial production begin using Fiscal Year 1986 funds?

General Wagner. The $17 million appropriated by Congress was reduced to $15.8 million by the congressionally directed undistributed inflation cut and Gramm-Rudman. There will be little, if any, funds remaining after completion of the development effort. Additionally, the funds expire in September 1987 and contract award will not be until 3rd Qtr fiscal year 1988.

LHX

Question. The Army is requesting $44.4 million to continue advanced development (AD) of the LHX. The LHX program has become the subject of much controversy, in part because of doubt that a valid requirement exists for a new aircraft, and in part because of the very high cost of the program.

Last year, the Congress reduced the budget request for LHX. Subsequently, the Army announced that it was withdrawing planned FY 1987 funding for full scale development (FSD) because of that Congressional action. On the other hand, the Army has said all along that it would not start FSD until a satisfactory conclusion of AD had been achieved.

Aren't these two positions inconsistent?

General Wagner. No, these positions are totally consistent. If the program had been funded as requested, advanced development would have been completed in time to support a DSARC decision in July 1986 for a FY 1987 start of FSD. Since work was left unfinished an FSD start could not have been supported. To have asked for FSD funds would have been inconsistent.

Question. Why was the Army planning to fund FSD in FY 1987 prior to getting the answers it says it needs from the AD phase?

General Wagner. The Army was expecting the advanced development phase to end in FY 1986. Therefore, it was logical to plan for an FSD start in FY 1987. While it is true that the answers required to start FSD were not yet available, it is prudent to plan to continue work based on emerging results.

Question. What is the Army's current position on the criteria for entering FSD of LHX?

General **Wagner**. The Army's goals for LHX are unchanged. At the DSARC, scheduled for March 1987, the LHX program will be examined to see to what degree the goals have been met. If a significant improvement is achieved in lethality, survivability and availability, and if it can be a single pilot aircraft with reasonable savings in O&S and can be procured at reasonable costs, the Army expects to proceed to full scale development.

Question. The Army has provided the Congress with a preliminary report, dated March 10, 1986, on its analysis of light helicopter requirements.

There seems to be no attempt in that report to analyze and quantify operating and support costs. Why is that?

General **Wagner**. The report is in response to the SASC. There was no requirement to include an analysis of operating and support costs. This information will be included in the report to the SAC required by 1 August 1986.

Question. The report includes the statement: "When reduced operating and support costs attributed to increased operational availability are considered, LHX appears to be cost competitive overall in the long term."

Absent any analysis, what is the basis for that statement?

General **Wagner**. The Army has been collecting and analyzing operating and support costs to include in the Cost and Operational Effectiveness Analysis (COEA) since mid-1985.

Question. We are facing Gramm-Rudman-Hollings over the next five years. How long is the "long term" referred to in the quoted statement?

General **Wagner**. The "long term" is the operational life of the LHX system. Operation and support cost savings will begin to accrue well after the five years of Gramm-Rudman, in 1996 and extends to approximately 2025.

Question. The full COEA of the LHX is supposed to be available by August, 1986.

Who is preparing the COEA?

General **Wagner**. The COEA is being prepared by the US Army Training and Doctrine Command.

Question. What will it include in addition to the preliminary study cited above?

General **Wagner**. It will include in addition to what was in the report to the SASC; results of force on force effectiveness analysis, additional performance analysis of all alternatives, procurement and operation and support cost analyses, analysis of alterantives on a fleet basis, a more detailed effectiveness analysis, and a description of the tactics planned for employment of the LHX.

Question. What plans, and what budgeted funds, are reflected in the FYDP for upgrades to the UH-60 and the AH-64? Provide details for the record.

General **Wagner**. Upgrades reflected in the Five Year Defense Program (FYDP) to the UH-60 are as follows:

[By fiscal year]

	1985	1986	1987	1988	1989	1990	1991
Nap-of-the-Earth Avionics	.9	1.1	1.6	1.4	1.6	1.3	
Aviation Night Vision Lighting	.4	1.5	1.5	1.8	2.1	1.6	
Wire Strike Protection		.6	1.0	1.1	1.3	1.0	
Hover Infrared Suppressor System			11.1	12.4	14.6	11.3	
Crashworthy Fuel Cell			6.4	11.1	12.5	26.6	
Flight Data Recorder			.3	3.7	4.4	3.4	
HELLFIRE			1.0	21.0	16.9	16.4	
Global Positioning System					6.7	3.4	
3400 Shaft Horsepower Gear Box				5.8	6.8	5.3	

For AH-64 FYDP reflects upgrades as follows:

[By fiscal year]

	1985	1986	1987	1988	1989	1990	1991
Airborne Target Handoff System			26.7	11.7			

ADVANCED TECHNOLOGY ENGINE

Question. The Army is requesting $111.3 million to continue development of the Advanced Technology Engine (ATE), which would power the LHX. The ATE is being designed to provide 1,200 shaft horsepower (SHP), with growth potential to 1,800 SHP. The current improved T-700 has 1,560 SHP.

Why does the Army need another engine in the same power range?

General **Wagner**. The T-700 is a good engine. But it is heavier, less fuel efficient, more costly to produce, and requires more maintenance than an engine built using today's technology. The contractor teams developing the T-800 have made commitments in firm-fixed price contracts to achieve greatly reduced fuel consumption, maintenance costs, and procurement costs when compared to the T-700 engine. The Army needs the new engine because it cannot afford a less efficient, more costly engine.

Question. What specifically are the other possible applications for the ATE, besides LHX?

General **Wagner**. The T-800 is being developed to have board applications in light aircraft, including tilt-rotor, plus hovercraft and ground power stations. Some specific examples where the T-800 could possibly be used are: Bell 205, Bell 212, Bell 412, Bell 214, and Sikorsky S-76 helicopters, and similar helicopters manufactured in Europe such as the Dauphin. Applications in medium transport fixed wing might include the DeHaviland Dash 4, the Twin Otter, the Shorts Brothers 330, and some Rockwell Aero Commanders. Fixed power plant installations may include generators for rock crushing plants as well as remote mining and exploration sites, villages and military camps.

Question. Please describe current Army development plans for ATE. Are two developing teams to be carried through preliminary flight rating?

General **Wagner**. ATE, or the T-800 Engine as it is now called entered full scale development in July 1985, with a competitive selection of two contractors each. At preliminary flight rating, when each team will have 1500 hours test experience on their engine, a source select-evaluation board will select a winning team to continue full scale development. This will be about September 1988. The production decision is scheduled for January 1993, and the team that completed development will produce up to two lots together before being required to compete for production shares.

ADVANCED TECHNOLOGY ENGINE—COSTS

Question. Why is that? Why has the cost increased by 46 percent?

Last year's Army documentation showed an estimated total cost to develop ATEs $557 million. This year's documentation shows $813 million for the same purpose.

General **Wagner**. The cost of the program has not increased. There is a decimal point error in the "to complete" column of the Army's internal programming documents that was missed in transcribing data to the budget request. In 1992, rather than $297.981 million, the figure should have been $29.798 million. This amount is needed in 1992 to fund integration of the T-800 into LHX and engine support during operational testing. As stated in the narrative of the Descriptive Summary, there has been a marginal decrease in the cost of ATE (T-800) development.

Question. Can the Army still afford this program?

General **Wagner**. Yes the Army can afford the program at $557 million, through 1992.

AIR-TO-AIR STINGER

Question. The Army has been pursuing development of an air-to-air capability. That was envisioned as needed for self-protection of helicopters against Soviet helicopters which possess such capability.

No funds are requested for fiscal year 1987. Why is that?

General **Wagner**. $28.4 million was included in the Fiscal Year 1987 OSD Budget to integrate the Air-to-Air Stinger on the AH-64, AH-1S and UH-60. These funds were later decremented in anticipation of accelerating this program via a fiscal year 1986 reprograming action. This initiative is to partially offset the existing air defense deficiency, as a result of the demise of SGT York.

Question. How much has been expended to date on this program?

General **Wagner**. $30.8 million of RDTE funds will have been expended on this program through the end of fiscal year 1986.

Army Fiscal Year 1987 Budget documentation says "the lack of a helicopter air-to-air capability is assessed as the highest materiel priority in the Army aviation mission area analysis."

Question. Is the statement correct?

General **Wagner**. Yes, sir.

QUESTION. Please reconcile that statement with your cancellation of Air-to-Air Stinger.

General WAGNER. The Air-to-Air Stinger has not been cancelled. In fact, we are attempting to accelerate the program not only to address the aviation deficiency, but also to partially offset the air defense deficiency, resulting from the demise of SGT York.

QUESTION. What do you intend to do to protect our helicopters?

General WAGNER. The Army is equipping its helicopters with the Air-to-Air Stinger as a low cost and effective interim solution. Additionally, we are refining our air-to-air tactics and doctrine in order to more accurately define the required flight envelope. We will then identify the weapons (missile and gun combinations) and tactics which will defeat the threat. Protection of our helicopters will ultimately require a combined arms solution.

A reprogramming action for FY 86 in the amount of $26.0M has been accomplished and rests with OSD.

AQUILA

QUESTION. The Army is requesting $91.9 million for engineering development (ED) of remotely piloted vehicles. Of that sum, $51.9 million is to continue ED of the Aquila, and $40.0 million is for ED of a FLIR for Aquila.

The trouble-ridden Aquila program continues to be a matter of great concern. The Army has already spent in excess of $700 million on Aquila, and recently was forced to restructure the program because of poor test results.

What is the current status of the Aquila program?

General WAGNER. The Aquila program is currently in development testing II (DT II). We originally entered DT II in April 1985 but cancelled it in September because we continued to encounter technical problems that had been indentified during contractor preliminary qualification testing (PQT–C). We entered DT II last year expecting that Lockheed could fix those problems on a non-interference basis during the early phases of the test. When it became clear that Lockheed could not, the Army formed a "Red Team" to assess the readiness of Aquila to complete development and operational testing. As a result of the Red Team's findings, the Army cancelled further testing until Lockheed could demonstrate that they had resolved these outstanding technical issues. They worked on fixing these during the period from September to December 1985 and demonstrated their achievements in January 1986. All of this was accomplished at Lockheed's own expense. With the supporting recommendations of the PM and the Red Team, the Army resumed DT II on 27 Feb 86.

QUESTION. Please describe the results of flight testing done over the past eighteen months. Who conducted these tests? Who monitored them?

General WAGNER. Preliminary qualification testing (PQT–C) by the contractor ran from January through March 1985. The results of that testing revealed deficiencies in acquiring and tracking moving targets, dead reckoning, automatic recovery, laser designation accuracy, backup recovery, and survey update. In April 1985, the Army began Development Testing II (DT II) expecting that

Lockheed could fix the problems identified during PQT-C on a noninterference basis. After DT II started, the Army convened a "Red Team" which found that these technical deficiencies were continuing. As a result of their recommendations DT II was stopped in September 1985 until Lockheed had demonstrated that they had fixed those problems. That demonstration was conducted in January 1986. During the demonstration, the contractor was able to achieve the following results:

60 laser designations on stationary targets (100%).
31 laser designations on moving targets (100%).
15 flights with handoff between different ground control stations.
Simultaneous control of two air vehicles.
Dead reckoning and survey update.
Consistent automatic recovery of the air vehicles.

In the area of detection, recognition and identification, the system was slightly short of the requirement for detection of off road targets in the wide field of view; however, in the narrow field of view, this requirement was exceeded. Therefore, performance of offroad detection was considered satisfactory. All other detection recognition and identification criteria were met. Criteria for laser designation, air vehicle recovery, tracking and moving target acquisition and central launch, recovery and handoff were met or exceeded. Survey update accuracy was judged to be acceptable and training procedures were assessed to be adequate for continuation into DT. The highlight of the demonstration, however, was a Copperhead live fire exercise. Nine targets were engaged with eight target hits—four against stationary targets and four against moving targets. The one miss was due to a munition failure. The PM and the Army's Red Team recommended continuing with development testing and the Army leadership concluded that Lockheed had shown sufficient progress to warrant continuing the program. As a result, development testing was resumed on February 27.

The contractor conducted PQT-C and the Lockheed demonstration. The Army is conducting DT II. All testing has been monitored by the Program Management Office (PMO), the Army Materiel System Analysis Activity (AMSAA) and the Operational Test and Evaluation Activity (OTEA).

QUESTION. What has been the performance of the data link in these tests? Were its anti-jam capabilities tested?

General WAGNER. Operation of all modes of the anti-jam (AJ) system have been demonstrated and meet the RPV mission requirements. The MICNS performance in a jamming threat environment has been verified through extensive subsystem level testing in environmental and anechoic chambers. Testing at the RPV system level was conducted by the Office of Missile Electronics Warfare (OMEW) in anechoic chambers at White Sands Missile Range, NM. This testing verified the robustness of the MICNS in a jamming environment and proved that the MICNS will provide the RPV system with the jamming immunity required to meet the threat. In addition to the testing, OMEW verified though susceptibility analysis that there were no design flaws that would lead to a data link vulnerability to reactive jammers. Actual flight testing of the MICNS data link in a jamming environment will be conducted in Operation Testing II (OT II).

The only problem that remained with the RPV data link was related to its operation in the non-jamming mode. A problem with signal phase noise in the original synthesizer design prevented the data link from operating in the clear mode (non-AJ mode). This problem has been corrected by a redesigned synthesizer.

Question. What are the decision points on program cancellation and when will they occur?

General **Wagner.** When the Army cancelled Development Testing II (DT II) last year, the Aquila Full Scale Engineering Development (FSED) was extended by 12 months to allow Lockheed, at their own expense, to demonstrate that they had resolved the technical issues identified by the Army. With the FSED extension, the Army inserted clear "go/no go" decision points at which the Army could cancel the Aquila program if it failed to meet scheduled objectives. The first of these points occurred following the Lockheed demonstration in January 1986. The purpose of that demonstration was to show that Lockheed had fixed the problems that had caused the cancellation of DT II. Because this demonstration was successful, the Army leadership approved the go-ahead of the program at that point. The remaining decision points are:

Completion of DT II—May 86.

Completion of Collective Training for OT II—Aug 86.

Army System Acquisition Review Council (ASARC) III—Mar 87.

Defense Systems Acquisition Review Council (DSARC) III—Apr 87.

Question. What specifically is proposed to be done for $91.9 million of FY 1987 funds?

General **Wagner.** The actual RDTE requirement for Aquila in FY 1987 are as follows:

[In millions of dollars]

Purpose	*Amount*
FLIR development and integration	40.7
MICNS support to operational test II	4.6
Aquila/Skyeye survivability test	4.9
Training support (PM Trade)	3.5
New organizational and operational (O&O) concept test	4.3
OT II system fixes	6.0
Test program set development, PMO and MICOM Lab Support	10.9
Other new work (additional air vehicles, other government agency (OGA) support, pre-production development, producibility engineering proposals, management reserves	17.0
Total	91.9

Question. Why will that work cost $91.1 million, rather than the projected cost of $16.4 million which appeared in the FY 1987 column of the FY 1986 budget?

General **Wagner.** The first point to be made is that the FY 1986 budget did not reflect the actual projected FY 1987 Aquila program requirements. An ASARC level review in December 1984 established the FY 1987 requirement at $47.1 million. Of this total, $22.1 million was for FLIR development and integration, $4.0 million was for modification of an Early Operational Capability (EOC) system and $21.0 million was for Aquila and government in-house support. At the time these requirements were developed, testing of the basic Aquila day system was to be completed in FY 1986. When the program was restructured in September 1985, operational testing II (OT II) was slipped into FY 1987, the FLIR program was extended and necessary additional work was incorporated into the program.

As a result of Aquila program restructuring, the $47.1 million requirement increased to $91.9 million which is reflected in the FY87 President's Budget. The December 1984 requirement for the basic day system, $21.0 million, was reduced to $10.9 million since planned test program set development work had to be deferred until FY 1988 and beyond. In addition, the $4.0 million EOC system modification effort was eliminated. However, the addition of new work and operational testing contributed $40.3 million to the FY 1987 requirement. The direct cost of operational testing is estimated to be $10.2 million which will be shared by the government and the contractor. The government share is $5.1 million which is distributed among the program elements. The $40.3 million is broken out as follows:

[In millions of dollars]

Purpose	*Amount*
MICNS support to operational test II	4.6
Aquila/Skyeye survivability test	4.9
Training support (PM Trade)	3.5
New organizational and operational (O&O) concept test	4.3
OT II system fixes	6.0
Other new work (additional air vehicles, other government agency (OGA) support, pre-production development, producibility engineering proposals, management reserve)	17.0
Total	40.3

The FLIR effort was restructured to accommodate the basis Aquila system schedule stretch and to correct a FLIR payload/Aquila system interface problem resulting from changes made to the basic Aquila system in FY 1985. These two factors caused the FY 1987 FLIR cost to increase $18.6 million over the old requirement of $22.1 million to a total of $40.7 million. The sum of $10.9 million for the basic system, $40.3 million for new work and $40.7 for FLIR work totals $91.9 million.

QUESTION. The idea of RPVs seems inherently sound, and likely to provide great operational benefits. It also suggests, perhaps intuitively, that such devices will be simple and economical. For example, the Army appears to be enjoying great success with the Skyeye RPV.

Has the Army sought to draw any lessons about how Aquila has become so cumbersome and costly?

General WAGNER. First, let me address the issue of Skyeye's success. While the system has enabled us to gain valuable experience in the employment of RPVs, I would not state that our experience with Skyeye has been an unqualified success. We have flown 385 hours on Skyeye through the 21st of March, and have had six crashes, three of which were unrepairable. Two of those crashes were attributed to problems with the parachute recovery system which we've had to redesign. We've had reliability problems in both the air vehicle and the ground control station because the commercial components were not designed to operate in the high heat and humidity in which we're operating. The system is contractor operated. The air vehicle is flown in the same manner as a pilot flies under instrument flight rules (IFR) using azimuth and distance measuring equipment (accurate to within 2 miles) while the payload operator uses the on-board sensor. The system does not have an anti-jam data link. In the low intensity combat environment the Skyeye system is presently operating in, its unhardened data link has been disrupted by local radio frequency interference and air vehicle control lost. The whole Skyeye experience has served to convince us that the requirements we've set for Aquila are valid. With regard to lessons learned from the Aquila program, the Army recognizes the principal factors contributing to RDTE cost growth and difficulty in program execution. Foremost was an incomplete understanding by both the Army and its principal contractors of the complexity of a system with Aquila's capabilities and the effort needed to produce it. Additional problem areas have been in stablilizing requirements, management and funding. Through recent intense management and a hard line with the Aquila contractors, the Army believes that past program problems and risks have been mostly resolved. We're watching our procurement of the nondevelopment item (NDI) Corps Intelligence and Electronic Warfare (IEW) Unmanned Aerial Vehicle (UAV) very carefully to be sure we don't reencounter the same problems we've had with Aquila.

Question. To what extent has "gold plating" contributed to this unfortunate situation?

General **Wagner.** "Gold plating" connotes unnecessary capabilities. The Aquila is not gold plated and it is just now meeting the minimum Army Target Acquisition, Designation, Aerial Reconnaissance System (TADARS) requirements. The problem we have had is that we tried to go from no capability to a very complex capability in one step and we ran into problems along the way. In the meantime, we had other manufacturers coming in and saying that they could build an RPV sooner and more cheaply than Aquila. What they didn't say was that their system didn't meet the operational requirements of an Army TADARS system. They would tell us that they could always build in an anti-jam data link later, and modify their system to provide automatic launch and recovery and so on. When we added all this up, however, we found that their systems would cost just as much as Aquila, and in the final analysis, take longer to field.

We've had Aquila flying for six years, and the problems we've had with it deal with trying to get these capabilities into the system. We would anticipate encountering those same type problems if we tried to incorporate Aquila's features into these other systems too. Aquila flight operations are automatic. This means that it does not require a fully trained pilot to fly and navigate the RPV. Aquila has a hardened, two-way data link that prevents the enemy from capturing your air vehicle, from using your transmissions for his own purposes, or from jamming your use of the air vehicle. The Aquila is designed against military specifications for world wide deployability. The Aquila has an on-board laser rangefinder/designator that enables it to designate for laser guided munitions well forward of the forward line of troops, to cue Air Force aircraft to targets, and to precisely locate targets for artillery fire. This capability will make a significant contribution to the outcome of the battle, specifically by enabling us to engage enemy forces beyond the line of sight before they can engage us. These are not "goldplated" requirements. These are real requirements that we must have in the system to insure that the equipment we take to war, wherever that is, will work when we get there.

Question. What plans has the Army made to rapidly acquire alternative systems, such as Skyeye, if Aquila is cancelled?

General **Wagner.** The Army has made no plans to acquire an alternative system if Aquila is cancelled. The Army is planning to procure an off-the-shelf system to satisfy the Corps Intelligence and Electronic Warfare (IEW) Unmanned Aerial Vehicle (UAV) requirement; however, our analysis indicates that it will be quicker and cheaper to complete the Aquila program than to upgrade an off-the-shelf RPV to meet the target aquisition, designation and aerial reconnaissance (TADARS) requirements. With Lockheed's successful demonstration in January, we believe that the major problems we have had with Aquila are over. If, however, Aquila fails to successfully complete DT II or OT II, the Army is prepared to cancel the program and acquire an alternative system. The problem we face is that no off-the-shelf RPV will meet the TADARS requirements; therefore, if Aquila is cancelled additional RDTE will be needed to modify an off-the-shelf RPV to meet those requirements.

TACTICAL EXPLOSIVE SYSTEM (TEXS)

Question. The Army is pursuing development of the Tactical Explosive System (TEXS) to provide an anti-armor ditching capability. The basic concept is that previously installed buried pipe can, on short notice, be filled with liquid explosive and detonated, thereby creating ditches to impede movement of armor.

Last year, the Committee noted that two candidate explosives were available, and insisted that a full and fair competition be held. The Committee also stated that it expects the Army to ensure compatability with NATO systems.

What is the current status of Tactical Explosive System (TEXS) Development?

General **Wagner.** The Market Investigation of the TEXS program is ongoing. The Milestone I Program Review is scheduled for June 19, 1986.

Question. What plan does the Army have for conduct of comparative testing of Nitromethane and Blasting Agent, the two candidate explosives?

General **Wagner.** Side by side comparative testing of candidate systems will be conducted in the second and third quarter FY 1987.

Question. When does the Army expect to make a decision?

General **Wagner.** The Milestone I decision will be made in June 19, 1986. The Milestone III Decision will be made in the second quarter of FY 1988.

Question. West German officials stated in December 1985 their intention of using nirtromethane. Their reasons include the absence of complicated and expensive mixing equipment, the ability to download and reuse the explosive, and non-toxicity. How does the decision impact on the Army's plan to ensure NATO compatibility?

General **Wagner**. West German officials have been invited to participate in the ongoing evaluation and testing of candidate systems. The participation of West German officials, in addition to assisting US Army consideration of NATO compatibility issues, will provide West German officials additional data upon which to make a national decision on which system is preferred for the German Army Tactical Anti-Armor Ditching System.

Question. Does the Army agree with the analysis of nitromethane made by the West Germans?

General **Wagner**. In general US evaluation of the conceptual nitromethane system is similar. However, just as the West Germans recognize, the attributes of the nitromethane system evaluated against the total Tactical Explosive System requirement vice the special border barrier requirements may lead to a different conclusion. The continuing West German testing and evaluation program is oriented at identifying the best *tactical* system.

DEMILITARIZATION OF CHEMICAL WEAPONS

Question. The demilitarization of existing, obsolete chemical weapons remains a matter of great concern. The Army has been pursuing two concepts, referred to as "baseline" and "cryofracture" for possible use. An independent review commissioned by the Army concluded, in November 1985, that the cryofracture system "offers significant potential advantages" and recommended pursuit of both concepts until uncertainties in the cryofracture approach could be resolved. Shortly thereafter, the Army stated its intention of dropping the cryofracture.

Why was such a step comtemplated, particularly in light of the findings of the review panel?

General **Wagner**. The Army was evaluating how it could comply with Public Law 99–145 which established a deadline of September 30, 1994, to have the unitary chemical stockpile completely destroyed. In its evaluation, the cryofracture technology was considered, however, due to the relative early stage of development, it was felt it could not be fully tested and readied in time to support the 1994 deadline.

Question. Subsequently, the Congress directed the Army to continue examination of the cyrofracture concept. What steps has the Army taken to comply with that direction? Provide details of any contract actions taken, and a description of the work to be done, together with milestone dates.

General **Wagner**. The Army requested and received a complete side by side layout of the cryofracture technology and the baseline technology on February 1, 1986. This review focused on what had to be done in order to meet the imposed deadline and the structure of the two technology programs to accomplish the tasks. The Army decided that the cryofracture technology program presented warranted support and approved continuation of the program. To date, testing of the cryofracture process has only been done with simulant filled munitions. Tests must be conducted with actual agent-filled munitions with explosives and data on effluents must be documented from the incineration of the material. These tests are scheduled for the next twelve months. The contractor is currently working on the test plans.

Question. Given the findings of the review panel, it appears that if one of the concepts were to be dropped, it ought to be baseline system. Has the Army considered doing that? If not, why not?

General **Wagner.** The Army initiated new technology evaluations for the destruction of the aging stockpile in 1982 with the goal of reducing costs and improving process efficiency, safety, and political and social acceptability. Parallel to the new technology effort, proven baseline technology designs were improved and tested at a pilot facility at Tooele Army Depot, Utah. Currently the baseline technology will be used at the demilitarization site on Johnston Island in the Pacific Ocean; however, the technology planned for any other site at this time will depend on the outcome of the cryofracture technology development and testing. The demilitarization review panel referenced also made statements concerning major shortcomings of the cryofracture process in relation to the lack of testing and experience with actual toxic chemicals. Until these tests are completed, neither process will be dropped.

Question. Provide for the record a funding profile by fiscal year for the demilitarization program if the baseline system is used, and if the cryofracture system is used. State in each case the total expected costs.

General **Wagner.** The estimated funding profile for the demilitarization program using the baseline system is included in the Chemical Stockpile Disposal Concept Plan furnished to Congress on March 15, 1986. Three alternative cost profiles are included ranging from $1,864 million to $1,972 million. Costs for the cryofracture system are still being developed. It is anticipated that some cost savings would occur by using cryofracture technology.

FORWARD AREA AIR DEFENSE C^2I

Question. The Army is requesting $82.1 million to continue development of Forward Area Air Defense Command and Control (FAAD-C^2), formerly titled "SHORAD C^2." This program is to provide for the integration of weapons, radar information and data devices into a functional, automated system.

Last year, the Army provided testimony on a restructuring of the program. Presumably, that new program is the one which is being pursued today.

Does the program continue to consist of three increments? Please describe them briefly, and provide details for the record.

General **Wagner.** No. Last year we reported that the program consisted of three elements: (1) a basic SHORAD C^2 architecture using existing sensors, (2) interfaces with additional sensors (growth program) and, (3) interface with the Army Command and Control System (ACCS) (growth program). As a result of the Forward Area Air Defense Working Group analyses, we have revised the program. These recommendations were briefed to the Secretary of Defense on January 8, 1986. The FAAD Command Control and

Intelligence (FAAD C^2I) portion of the FAAD Program consists of three components: (1) FAAD C^2 referred to above which provides the systems integration, C^2 architecture and non-developmental ground sensor, (2) Aerial sensor which provides the capability to see low flying or hovering helicopters at and beyond the forward line of troops (FLOT) and (3) the coordinated contribution of active and passive combat identification systems or both weapons and sensors.

QUESTION. Is the development cycle still 70 months long? Is the IOC still late FY 1991?

General WAGNER. Present program funding dictates an IOC of 2nd Qtr FY 1992. However, the Army plans to adjust the FY 1988–92 Program Objective Memorandum (POM) to support an IOC of 4th Qtr FY 1990. This will result in a development program of 48 months.

QUESTION. Last year's budget projected that FY 1987 requirements for the program would be $57.8 million and that total program cost would be $440 million.

Why specifically is $82.1 million now requested for FY 1987? The only explanation provided in the descriptive summary is that the increase is "to fully fund the ESED."

General WAGNER. FY 1987 funding was increased to support a more efficient development program and support an earlier IOC that is synchronized with the weapons fielding. Plans include system filed tests in 4th Qtr FY 1989.

QUESTION. Why is the total program cost now lowered to $377 million? You will recall that last year we asked why the total cost had been risen to $440 million in FY 1986 from $375 million in FY 1985.

General WAGNER. The decrease in development funding is based upon a shorter, more efficient development cycle and incorporation of common ACCS hardware and software into the the program.

QUESTION. The FY 1987 descriptive summary shows FAAD C^2 having an estimated total cost of $900 thousand. Presumably this is a typographical error. What is the correct figure. Is it $900 million?

General WAGNER. The correct procurement estimate is $763 million.

QUESTION. What are the specific differences in equipment types, quantities and unit costs from last year, when the estimated total procurement cost was $523 million?

General WAGNER. The primary increase in procurement cost supports the acquisition of 121 ground based non-developmental senors. Equipment types, quantities and unit costs of other C^2 hardware have not significantly changed.

QUESTION. General Wagner, an area of particular concern has been the necessity of obtaining a new radar as part of this system. Last year, you testified to the committee: "An agreement worked between Congress, OSD and the Army in July 1983 called for development of the basic system architecture first, relying on existing hardware to the extent possible and to defer a dedicated radar until field experience has been gained with C^2 architecture and further cost and operational effectiveness analyses conducted."

Army documentation now shows that the Army intends to issue a solicitation for a new sensor in FY 1986, and to do a "live shootoff" for new sensor selection in FY 1987. Please explain this intention.

General WAGNER. The Forward Area Air Defense (FAAD) WG analyses shows that there is a critical need for a command, control and intelligence system that can provide alerting and cueing information to the Forward area air defense and maneuver forces. The current Air Defense C^2/sensor capabilities to include PATRIOT HAWK and other service assets cannot provide the low level, forward air picture to support division air defense and combined areas assets. To support the total FAAD concept we plan to prepare a solicitation for a non development ground sensor in FY 86. Contractors will be asked to demonstrate their sensor candidates in late 1987. We expect this sensor to provide surveillance coverage for fixed wing and rotary wing aircraft over the division area.

QUESTION. Does this appear to you to be consistent with the agreement you cited last year?

General WAGNER. Yes. The 1983 agreement was prompted by concern over the total projected program cost which at that time approached $1.8 billion. The agreement was to defer one of the major cost elements which was the development and procurement of a new, dedicated sensor. The agreement also emphasized the use of already developed equipment. The FAAD WG analyses again confirmed the need for internetted sensors to replace the existing FAAR which is clearly inadequate to meet the threat. PATRIOT, HAWK, and other service sensors cannot fill the low level airspace surveillance void over both the division area and beyond the FLOT. The restructured program that supports the FAAD WG recommendations includes a replacement sensor system to cover this airspace. Market investigations have shown that already developed sensors can fulfill this critical need. Because of the criticality of these sensors to FAAD, we are planning, programming and budgeting for these sensors and, as we agreed, confirming the need and integration plans through Cost and Operational Effectiveness Analyses (COEA) and testbed experience prior to procurement of these sensors. This results in synchronization of the sensors fielding with the C^2 and weapons to fully support the integrated FAAD system.

QUESTION. What field experience has the Army gained with the C^2 architecture to warrant moving forward on a new sensor?

General WAGNER. FAAD C^2 testbed deliveries have begun. This will provide a surrogate C^2 system. Initially, sensor data will be obtained from HAWK air defense radars and Air Force AWACS through the AN/TSQ-73 Missile Minder. We have initiated action to integrate low performance radars, representative of the FAAR and radars representative of the proposed non-developmental FAAD C^2 ground sensor. We expect to be testing these sensors in the testbed in early FY 1987 prior to source selection or expenditure of significant resources on a new sensor.

QUESTION. How much of the funds provided for FY 1986, and budgeted for FY 1987, are associated with pursuit of a new sensor?

General WAGNER. In FY 1986, we plan to use about $300 thousand for solicitation preparation and in FY 1987 approximately $4.5 million is associated with the industry sensor shoot off demonstration. These are government costs for conducting the shoot off such as range time, flying hours, data collection. This demonstration is planned for late FY 1987.

ARMY COMMAND AND CONTROL SYSTEM (ACCS)

Question. What is the current status of the ACCS program?

General Wagner. The PM ACCS is presently finalizing his acquisition and fielding strategy for the ACCS program. The ACCS common hardware/software specifications have been reviewed by industry and associated government activities and the comments are being reviewed and incorporated as appropriate. The PM's plans, strategies and schedules will be presented to the Army leadership for approval during 4th quarter FY 1986. Upon approval the RFQ for the ACCS common hardware will be released.

Question. What is the program schedule? Provide for the record a timetable of major program events. Specifically, provide a plan detailing all phases and decision points including ASARC/DSARC reviews, procurement and testing plans, integration testing with applications software programs, ect.

General Wagner. The program schedule will be briefed to the Army leadership during 4th quarter FY 1986 for their approval. A conceptual program schedule for ACCS common hardware is as follows:

Army Leadership Review	4th QTR FY 1986
RFQ Release	4th QTR FY 1986.
ASARC I	May 1987.
Contract Award	June 1987.
Initial Deliveries for testing Start: [1]	
Commerical	September 1987.
Ruggedized	March 1988.
MIL SPEC	June 1988.
Development Tests [2]	Jun–Oct 1988.
Operational Tests [2]	Jul–Dec 1988.
ASARC III [3]	January 1989.
Exercise Production Option	February 1989.
Deliveries to support fielding of individual systems Start.	June 1989.

[1] Small quantities of hardware will be given to individual system programs, to allow individual system software to be ported to the hardware.

[2] The test period includes separate DT/OT of individual systems followed by testing of an integrated system. Individual system tests will focus on common hardware and individual system software issues. The integrated test will focus on software interoperability issues. Timing of the test window depends on the availability of enough individual systems to adequately test the hardware.

[3] The ASARC III Milestone represents a period during which ASARC's for individual systems will occur, and an ACCS common hardware full production decision will be made.

Question. Is there an approved Required Operational Capability (ROC) for ACCS hardware? If not, when will the ROC be approved? Is there any possibility that Army would attempt to procure billions of dollars worth of C^3 equipment without an approved ROC?

General Wagner. There is no ROC for ACCS. Army Regulation 11–39 is considered the requirements document for ACCS as a "System of Systems"; however, all control systems will have approved ROCs. These ROCs will be the basis for procurement of ACCS hardware, and the requirements will be addressed by the ACCS common hardware.

Question. What is the Development Test/Operational Test (DT/OT) plan? Will DT/OT testing be done for each software application? If not, why not? If problems arise in integrating the applications software programs into the selected ACCS hardware which will be forced to change—the software or the hardware?

General **Wagner**. A Developmental Test/Operational Test (DT/OT) is planned for each of the five systems (as well as all other Battlefield Automated Systems (BAS) after which a combined test of all will be conducted for interoperability. Problems encountered during test will be solved by correcting either the hardware or the software depending on the severity of the problem. Because one of the goals of ACCS is reusability of software, every effort will be made to eliminate any hardware dependencies. Therefore, the thrust will be to favor changing the software to ensure its portability.

Question. What is the total ACCS hardware procurement plan through 1995? What is the type, quantity and cost of terminals to be procured each fiscal year?

General **Wagner**. Those specific figures have not been finalized. They are being developed as a part of the final proposed acquisition and fielding strategy for ACCS programs which will be presented for approval to the Army leadership during 4th quarter FY 1986. Required funding levels will be included in that presentation. At that time, adjusted hardware requirements by year in terms of quantity, equipment type, and funding will be incorporated into the FY 1988 President's Budget.

Question. What is the acquisition plan? How will the ACCS contract be awarded? Will only one contractor be selected? Will production contracts by awarded prior to successful DT/OT testing and approval by the ASARC/DSARC?

General **Wagner**. The final proposed acquisition strategy will be presented for approval to the Army leadership during 4th quarter FY 1986. The current plan is for a competitive award to be made consisting of a single contract to produce the ACCS common items as a fixed price buy for the first year with four fixed price yearly options. The yearly options will have pre-priced quantity range options to allow for change in quantity. The initial 2 year quantities are for integration into systems and conduct of DT/OT. After DT/OT, Type Classification, and ASARC III approval, subsequent procurement options will be used for production buys.

Question. What is the plan for integrating the DOD-sponsored VHSIC program into ACCS? Describe the schedule of actions to be taken.

General **Wagner**. Since this is an NDI procurement, there are no VHSIC design requirements. Use of VHSIC or VHSIC-like in an offeror's proposed equipment will enhance his bid from a size weight, power, and capability standpoint.

Question. Under what program elements will ACCS hardware be procured?

General **Wagner**. ACCS hardware will be budget within the individual budget lines of the systems utilizing ACCS hardware. The buy will be coordinated by PM ACCS.

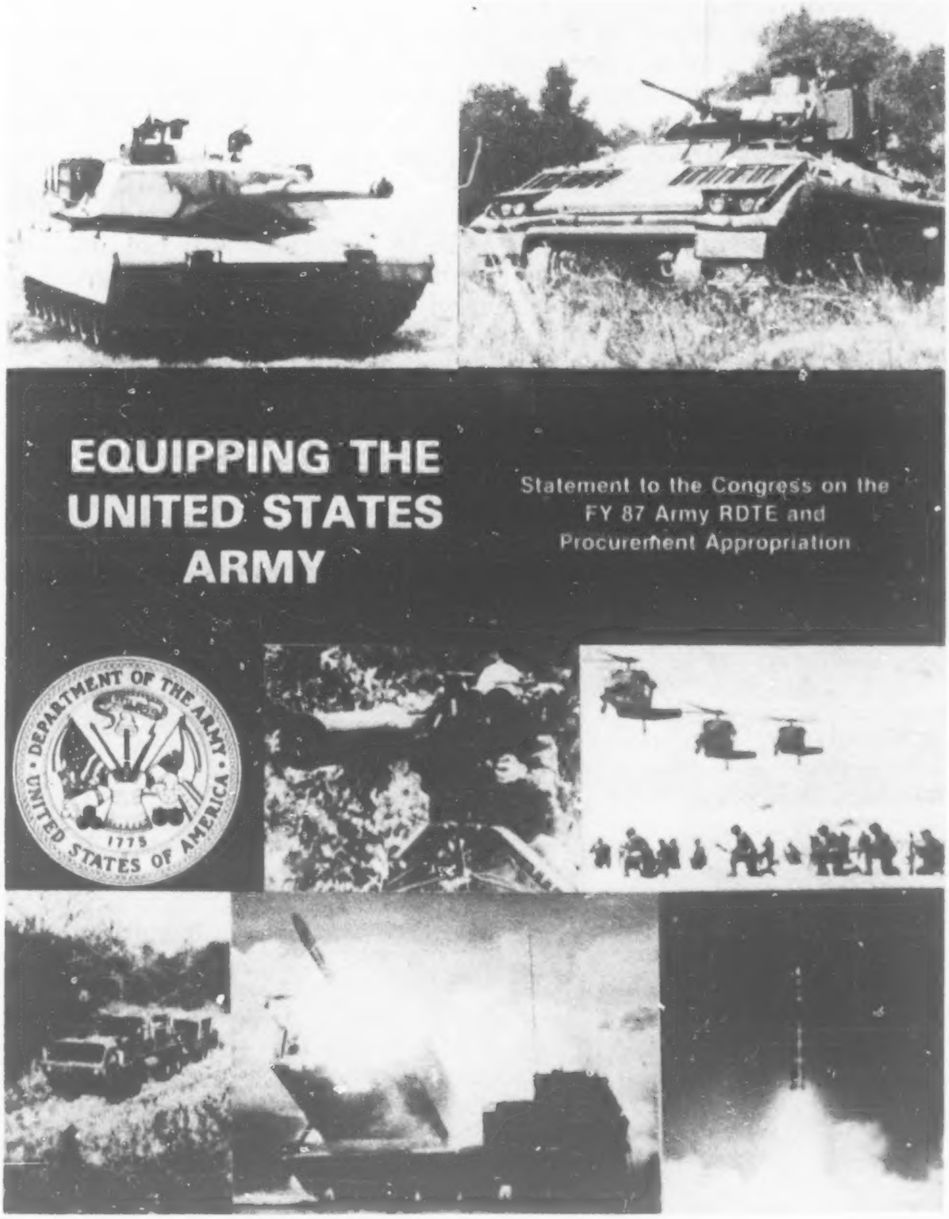
Question. How will all of the current Army C^3 programs be transitioned to ACCS in both hardware and software?

General **Wagner**. The first stop in the ACCS program will be to transition the five control nodes consisting of MCS, AFATDS, FAAD C^2, CSSCS and possibly ASAS. MCS software is presently being written in Ada and PM OPTADS will field this software on the current MCS family of equipment. MCS NDI equipment will be fielded at the other four control nodes to provide early ACCS experience and valuable information to the ACCS program. When the ACCS common hardware and software is selected, the MCS software will be integrated with it for subsequent fielding. The AFATDS, FAAD C^2, and CSSCS programs will be written in Ada and will integrate their software directly into ACCS hardware. The ASAS software is not presently being written in Ada, and because of security requirements of the ASAS program, will not initially use ACCS hardware. They will work under the ACCS program to move toward these objectives and will continue to ensure interoperability thru ACCS protocols, standards, and interface specifications. As the ACCS program progresses, other components of the C^2 architecture will be evaluated for use of ACCS common hardware and software.

[CLERK'S NOTE.—End of questions submitted for the record.]

Mr. AUCOIN. The committee will stand adjourned. We thank the witnesses. We will stand adjourned until 1:30 on Thursday, March 20th.

[CLERK'S NOTE.—The joint statement of Dr. Sculley and General Wagner referred to on page 1 follows:]



EQUIPPING THE UNITED STATES ARMY

Statement to the Congress on the
FY 87 Army RDTE and
Procurement Appropriation

THE ARMY'S FIRST PRIORITY

THE SOLDIER

DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 20310

February 18, 1986

Members of Congress:

The Army's pursuit of modernization and a balanced material acquisition program is underway to meet the goal of equipping our Army to respond to a constantly changing worldwide threat. Force modernization, in reality barely begun, is essential in an Army that has little choice but to capitalize on advanced technology. If today's research and development is to bear fruit in the future, the effort must focus on achieving key operational capabilities in less time with fewer false starts. The Army's primary focus is on five Key Operational Capabilities: Command, Control and Communications (C-Cubed); Reconnaissance, Surveillance, and Target Acquisition; Battlefield Sustainment; Battlefield Lethality and Soldier Performance Enhancement. We will continue stressing the procurement of off-the-shelf "non-developmental" systems to insure a reduction in equipment fielding times and savings in development costs.

The following introduction provides a brief overview of the research, development and acquisition objectives and ongoing efforts to meet these objectives. The weapons systems and other equipment are categorized by specific Army mission areas and are designed to show the current strengths and weaknesses in these mission areas. Our hope is that the enclosed discussions will make the Army's request for each system meaningful by describing its intended use on today's, as well as tomorrow's, potential battlefield.

In addition to this statement, we are also making available to you the "1986 Army Weapons Systems" handbook, a consolidated reference for a number of our weapons systems.

It is an honor to represent the Army in working with this session of the 99th Congress.

LOUIS C. WAGNER, JR.
Lieutenant General, GS
Deputy Chief of Staff for
Research, Development and
Acquisition

J. R. SCULLEY
Assistant Secretary of the Army
(Research, Developmemt and Acquisition)

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INTRODUCTION

In FY87, the Army continues the long-term program of equipping our forces with the systems required to gain a qualitative edge over the Soviets. We ask your continued support in this effort; however, we are mindful of the necessity of reducing the deficit, and consequently remain committed to ensuring the dollars provided us are used wisely and efficiently. The continued Congressional support of the Army's equipment modernization program is paying dividends. As we move into FY87, it is essential that this positive trend continues to enable the Army to eliminate obsolescence, fill shortages, and strengthen our position relative to probable adversaries.

Our ability to measure and articulate changes in unit capabilities over time against a realistic threat force was vastly improved in 1984 with the development of the Measuring Improved Capability of Army Forces (MICAF) Study.

Improvements to the 1984 study have resulted in MICAF 85 which is expanded to provide data showing the capability changes of most divisions, separate brigades, and Armored Cavalry Regiments fighting a 1988 threat. Total Army major combat units warfighting capability improved 39% over the 1980-1985 period compared to a 1988 threat. The relative combat potential of the same force with the equipment projected to be fielded in 1987 is a 52% increase.

The FY87 combined procurement and RDTE request is for $24.2 billion. These funds will continue the improvement of the Army's near-term readiness posture, continue to modernize the total force, and support near and far term research and development. Progress has been made in meeting our requirements; however, the Army is still short the materiel to bring units up to the equipment level they require. Reduction of these shortages as quickly as possible is our highest priority. We must continue to procure additional quantities of equipment—currently fielded, product-improved, and new—for both Active and Reserve Components.

A brief review of the recent history of development in the Army's combat forces, and changes in the character of the combat operations they must prepare for, will help establish a basis for our current RDT&E and acquisition programs.

Fifteen years ago we recognized the need to modernize in all areas, but particularly in our principal weapon systems. At that time the Soviets were developing and deploying weapon systems at rates which indicated that they intended to establish a clear numerical superiority over the US and its NATO allies in terms of modern military forces.

Their forces and those of the other Warsaw Pact members were then numerically superior, but inferior in the quality of their equipment. Accordingly, the US and our NATO allies enjoyed a substantial qualitative superiority. The modernization program upon which we embarked in 1970 was designed to exploit our technology and use it to field systems which would continue that margin of qualitative superiority. That program has gone well. We have developed modern systems and are now acquiring them and modernizing our force.

As we proceeded with our modernization program, the Soviets moved much more aggressively than any of our estimates predicted. They increased their numerical advantage more than expected and, more alarmingly, have reduced, and in some cases reversed, the qualitative advantage we held. In Europe this means that Soviet and Warsaw Pact forces have fielded a modern motorized and armored force, a dense multi-system air defense, modern attack aircraft and helicopters, and a growing conventional tactical missile threat. By many of the measures which we have used to compare our forces, we have indeed lost ground. Consequently, the uncertainties for the Soviets in conducting a conventional campaign in Europe have been reduced and so has the deterrent posture of the US and NATO forces.

At the same time the military situation in the Third World has worsened. Soviet military power and influence have been increasingly projected there. In Southeast Asia, in particular, Soviet military equipment has been used to establish large and modern mechanized and armored forces. Developments in Africa and Latin America also confront us with a militarized Third World which is unstable.

Where have these developments placed us? While we have been modernizing, the Soviets have been increasing their numerical advantage and eliminating the qualitative gap. However, as these developments emerged, our military planners recognized the need to meet them, first, by developing doctrine for the employment of our new weapons and, second, by devising new organizations for our combat forces to meet our increasing worldwide commitments.

In 1972, the Army's primary mobility and firepower weapons systems were rapidly approaching obsolescence. A clear and immediate requirement to modernize these systems was evident. The Army leadership established a program to focus technology and development efforts on systems identified as being most crucial to execution of the Service's combat mission.

Five major development efforts emerged, termed the "Big Five." These systems, which will provide the mobility and firepower necessary to support the Army until the year 2000, are now being produced and fielded. They are the M1 Abrams main battle tank, M2 and M3 Bradley fighting vehicles, AH-64 Apache attack helicopter, UH-60 Black Hawk helicopter and the Patriot surface-to-air missile system.

The success of the Big Five programs was attributed to the focus established by the Army leadership, the Congress and defense contractors. Today, the requirement to distribute scarce resources to achieve maximum capability is more challenging than ever before. In 1972, our doctrine was oriented toward heavy forces; today we must have the capability to realistically engage threats across the full spectrum of warfare, from terrorism to the nuclear battlefield. The rapid advancement of technology, coupled with its broad application to weapons systems, makes it imperative to define requirements, develop systems and field hardware in the shortest time possible.

Recently, the Army Staff concluded a short, intense study to identify follow-on initiatives to the Big Five. From that study, a concept has been established to guide development and fielding of weapons between now and the year 2000.

The concept centers on "key operational capabilities," or those warfighting capabilities the Army must have to fight and win on any battlefield. The key operational capabilities provide a means of identifying the necessary systems, programs and technologies to ensure that priority Army research, development and acquisition efforts are supported in the annual program, planning, budgeting and execution cycles. The key operational capabilities are identified as: reconnaissance, surveillance and target acquisition (RSTA); command, control and communications (C3); battlefield lethality; battlefield sustainment and soldier and unit performance enhancement. Other capabilities such as strategic and intratheater lift were recognized as being critical, but are less affected by Army research, development and acquisition activities.

The concept of key operational capabilities capitalizes on those technologies where the United States has an advantage, for example, microchip technology and biotechnology. This competitive edge provides the potential to achieve a significant improvement in war-fighting capabilities, which will offset quantitative deficiencies.

The potential for improvement extends across the entire spectrum of fighting capabilities, including the areas of battlefield synchronization and deep-attack capability. Such an improvement will not only change the nature of land warfare but will also shape it in U.S. terms as opposed to those dictated by a potential enemy.

AirLand Battle is a major advance in doctrine. It addresses the battle activity in the rear, close-in, and deep areas as concurrent, synchronized operations. This doctrinal development is particularly bold in its concept for deep attack; that is, projecting combat power deep to attack the second and third echelons of the enemy force. This aspect of AirLand Battle is generally described as producing delay and disruption of these echelons, but by doing this, it does much more. Deep attack in AirLand Battle places the whole concept of Soviet campaign operations at risk. Thus, as we implement this doctrine, we will greatly increase the margin of uncertainty for the Soviets regarding the outcome of any conventional campaign and, therefore, restore the deterrent posture of our conventional forces.

It is important to note that this is a joint doctrine which provides the framework within which the Army and Air Force coordinate plans for R&D programs and for operations.

AirLand Battle is already being implemented with the forces and equipment now in the field. However, the full development of the power of this concept depends on the exploitation of emerging technologies in sensors to see deep, in smart munitions to strike deep, and in data processing and telecommunications to rapidly manage these resources. Our scientific and technology base in the US uniquely positions us to do this and, thus, to establish a major advantage over our adversaries in employing weapons on a modern battlefield.

Since the full capability of AirLand Battle doctrine will be underwritten by science and technology, it is particularly important that we sustain an aggressive R&D program to support it. To do less would be to ignore a major advantage we have in applying science and technology to leverage our combat power. To do less would also risk assuring the success of the Soviet strategy to develop superiority by fielding larger forces and matching or exceeding our weapons in quality.

Our plans for improving the capability of our light forces also require an aggressive applied technology program. The reorganization of these forces under the Army of Excellence program will provide for greatly increased deployability. These forces, however, need greater firepower to meet modern mechanized and armored threats.

A major task of the Army is to achieve synchronization of the AirLand Battle. It is expected that the potential enemy will outnumber us in weapons and in manpower. Our advantage must be gained by bringing to fruition the nation's capability in high technology, so that we may field the systems necessary to control the battlefield and offset enemy numerical superiority.

Another major task is to field a deep-attack capability for heavy and light forces. We must be able to detect, identify and attack enemy follow-on forces, command and control centers, and logistics operations. With their disruption, we can be successful; without it, we cannot.

One must never forget that the most crucial battle will be fought at the forward line of troops where the infantry and armor soldiers, with the support of all other arms, ultimately win or lose the battle. Hence, we continue to place geat emphasis on the weapon systems that are key to this battle.

The Army must, of course, continue to define and refine joint service operational capabilities. We fight as a team with the Air Force, Navy and Marine Corps and must coordinate our RDA programs with theirs.

The key operational capabilities provide the basis for the development of systems and programs to be emphasized in the 15-year period ahead. Specifically, each system in development must clearly demonstrate that its presence will significantly enhance the warfighting capabilities of the Army and that it will go into production before the year 2000.

The soldier is the ultimate recipient of all of our research, development and acquisition efforts. Today's soldiers are exceptional. They are well qualified, physically and mentally toughened by their training and led by competent and caring leaders at all levels.

Proper soldier-machine interface is receiving increased emphasis in the design of all our equipment. We continually encourage weapons makers and Army program managers to pay more attention to soldier-machine interface problems as they lay out a new system in the concept formulation stage. The soldier must be "in the loop." We ensure that proper attention is paid to the manpower function and requirement in relation to the hardware to make the system far more effective in battle.

The capabilities of our soldiers will be a determining factor in system design. With fierce competition for top-quality recruits facing the Army in the future, both qualitative and quantitative personnel demands will become critical. Weapons and equipment must be designed to fit the soldier and his fighting environment. Program managers and laboratory directors are insuring that the man-machine interface effort makes the machine fit the soldier. Proper equipment design can reduce the soldier's work load in the high stress combat environment.

Emphasis on soldier performance enhancements is producing increasingly improved support items for the individual soldier. New clothing and equipment technologies mean increased survivability for the smaller and more lethal force of the future. These include research in chemical fibers and fabrics to optimize flame resistance and relief of heat stress; evaluation of new experimental fabrics for ballistic protection; development of improved chemical protective clothing and equipment systems; improved desert camouflage and infrared signature suppression and lightweight cold weather protection. Microclimatic conditioning units for vehicle crews will be fielded in the M1A1 Abrams tanks.

The M1 tank is being brought to a new level of capability with the fielding of the new M1A1 model and plans for a future package of improvements for that superb tank. The M1A1 improvement program is aimed at both improved effectiveness and operational and sustainment (O&S) cost savings. The effectiveness improvements are:

- An independent thermal-imaging night viewer for the tank commander.
- Improved commander's weapon station.
- Improved range finder.
- Better survivability.
- Driver's thermal viewer.
- A battlefield management system.

The research, development, test and evaluation (RDT&E) began in fiscal year 1985, and introduction to tank production is scheduled for August 1988 or sooner, if possible.

Thinking beyond the M1-series tanks and M2-M3 fighting vehicles, we are developing a concept for a family of future armored combat vehicles. Scheduled for a late 1980s research and development start, this program will give the Army significant improvement in force effectiveness by exploiting high-technology improvements. The combat vehicle family will support our needs well beyond the year 2000.

Another example of the emphasis on increased lethality is in the munitions area. Technology is dramatically altering the approach to fire support. Massed fires are becoming precision fires. Advanced munitions will be directed at targets rather than at points in space. Their lethality will result from having a self-contained capability to select targets and home in on them.

These "smart" munitions represent the most significant change in conventional indirect-fire support in the Army's history. Microelectronic technology makes it possible to build into missiles and projectiles the ability to detect targets with a variety of advanced sensors. This technology will significantly reduce logistics and manpower requirements while increasing lethality.

The Army's current force structure initiatives reflect changing strategic concerns. As the focus shifted from Vietnam to the potential armored and mechanized battlefields of NATO Europe, force structure became heavier to counter the Soviet threat. Therefore, we applied technologies to support a heavy mechanized force; but in light of the current need for rapid deployment, we are seeking ways to reduce the average weight and size of equipment. Exciting advances in this process have produced a new nonmetallic composite armor, which has been tested on the M2 and M3 Bradley fighting vehicles. This plastic armor, reinforced with E-glass and S-2 fibers, has been demonstrated on a Bradley turret, with a weight savings of 15 to 20 percent. An unanticipated finding is that the glass laminate is a better damper of sound and vibration from the main gun than aluminum.

Trends in the force at large also reflect down-sizing. For example, the advanced field artillery tactical data system (AFATDS) now in development will be considerably better and smaller than its predecessor "Tacfire". In addition, the logistics community will replace large computers with smaller and easily portable models.

The Army is emphasizing improvement in ammunition logistics. The new initiatives include improved plastic packaging for current and future ammunition that will be lighter, less bulky, easier to handle, cheaper and will be easier to decontaminate, by possessing better nuclear, biological and chemical protection characteristics. A technology base program has been established for improvement of ammunition packaging and handling.

The demand for logistical support can be reduced by implementing the down-sizing and weight reduction initiatives in our "Army of Excellence" force structure goals. One of the driving factors in down-sizing the force is to make it more supportable and deployable; however, the anticipation of greatly accelerated consumption rates of supplies and attrition of equipment have made the challenge of improving our support capability even tougher.

The Army has recently established a number of "battlefield sustainment objectives." They reflect the complex nature of sustainment issues, but are ultimately concerned with reducing the demand for logistical support. The objectives are:

- Balance prepositioned war reserve stocks against requirements.
- Significantly reduce maintenance requirements.
- Eliminate unneeded weight and bulk.
- Reduce the money and manpower demands of the logistics system.
- Field survivable logistics support systems.
- Create a capability to manage mass casualties.
- Protect industrial-base resources.

Industrial-base preparedness is a matter of great concern. Wartime sustainability requires funding support for the necessary mobilization manufacturing capacity in U.S. industry. The objective of this program is to satisfy materiel demands at a prescribed level within one year of the decision to expand production. These plans involve billions of dollars and have not been well supported in the past. We must focus on this in the future, within the constraints of a limited budget.

We must maintain a limited number of government-owned manufacturing facilities which are either government or contractor operated. These plants manufacture major items, large-caliber munitions and special propellants that. Funding to support a "surge" production capability for selected, highly critical items is essential.

The Army is not standing still. Force modernization is real and must be completed. While we are working at improving our force through acquisition of new systems we must diligently conduct research and development for the future or we will place ourselves in the dilemma that faced us following the Vietnam conflict. To control this monumental task requires that we all work together to provide our most important asset—the soldier—the equipment needed to perform in a most effective manner. The RDA community is totally dedicated to that effort.

TECHNOLOGY BASE

Unrelenting quantitative and qualitative advances by our potential adversaries underscore the necessity for realistic, comprehensive, and innovative long range RDA planning for our Army of Excellence. Technology and telesis (progress that is intelligently planned and directed) are more important now than ever. During the past year, we have continued to improve our long range RDA plan, which is the starting point for our budget and 5-year plan preparation, and the roadmap for our technology base investment strategy. Our plan is built upon realistic threat forecasts, AirLand Battle Doctrine, frank assessment of our deficiencies as identified by the Battlefield Development Plan and Mission Area Analysis process and solid technology forecasting. The resultant technology base investment strategy matures technologies needed by future systems, exploits our current technological advantages, accelerates high leverage technologies and nurtures emerging technologies. Our hierarchy of RDA plans is extensive, comprehensive, consistent, and ranges from the HQ DA Long Range RDA Plan to the Mission Area Materiel Plans of our major development commands to the science and technology plans of our laboratories.

This year's FY88-2002 long range RDA plan supports achievement of five Key Operational Capabilities which are prerequisites to victory on the future battlefield. Capitalizing on those high leverage and emerging technologies for which we have an advantage, the concept of the Key Operational Capabilities permits us to realize the full potential of our nations technology capability.

The technology base is maturing technologies in time for future systems development and product improvements of current systems to eliminate deficiencies and seize opportunities. One example is the Light Helicopter Family (LHX) program. Army laboratories working with the other Services, NASA and industry are maturing the technologies required for LHX. A FY88 full scale development start for LHX would not be possible without these efforts. Examples include: advanced composite airframe structures; very high speed integrated circuit technology insertion; crew workload AirLand and man-machine interface simulation; advanced digital-optical flight control system, sensor fusion: automatic target recognition: survivability demonstrations; and expert systems for diagnostics. This technology is important to several other future systems such as the Armored Family of Vehicles currently in concept formulation. The LHX will be the first rotorcraft designed from the outset with the aid of extensive engineering simulation, mission simulation and wind tunnel testing.

The Army technology base continues to integrate, focus and apply high leverage technologies for each of the Key Operational Capabilities.

- Reconnaissance, Surveillance and Target Acquisition (RSTA)–Very intelligent surveillance and target acquisition technologies will permit the fusion of data from multiple sensors to provide information needed by the Army commanders on the fluid, complex battlefield of the future. Near-realtime presentation of ground based and airborne radar, optical and human intelligence will provide the needed increases in lethality and survivability. Millimeter wave technology is being pursued to permit a sensor to see and terminal homing missiles and artillery rounds to engage targets through battlefield smoke, fog and dust. Advanced visible and infrared technology is making a major contribution to our ability to passively detect and identify targets at night and under adverse weather conditions. This past year we demonstrated the first uncooled sensor array for night vision. AirLand battlefield environment tactical decision aids will provide information on terrain, weather and battle-induced contaminants and intelligence regarding the effectiveness of friendly or threat weapon systems and operations.

- Command, Control and Communications (C3)– Distributed C3 technologies and networks will enhance communications and the reliable distribution of information to all levels of command. Digital burst transmission techniques, millimeter wave and higher frequency spectra, and fiber-optics are being pursued to improve jam and intercept resistance and continual information transmission.

- Battlefield Lethality—Self-contained munitions technology will allow munitions after launch to autonomously search, acquire, select and home in on hostile targets. Benefits include increased kills per missile or round fired, greater survivability for the launch vehicle or battery and lower cost per kill. Advances in fiber-optics, infrared, electro-optical, radar, fuse, warhead and delivery system technologies are being pursued. Our Armament Enhancement Initiative Program is focusing technology efforts on defeating the armor threat of the 1990s. Recent accomplishments in battlefield lethality include the successful flight demonstration of the ground launched fiber-optic guided missile (FOG-M).

- Battlefield Sustainment- Logistics R&D is being expanded to improve weapon systems reliability and maintainability, reduce consumption, reduce manpower intensity and reduce operating and supportcost. Expert system technology for helicopter diagnostics and condition monitoring is being demonstrated to reduce the number of inspections and scheduled maintenance tasks by monitoring flight data. The cognitive skills of the expert maintainers and diagnosticians are instantly made available to the lesser experienced maintainer. Our food technology program has demonstrated a light weight mobile combat feeding system for the soldier in the field that provides high nutrition, prepackaged, labor-free hot meals for the unit on the move.

- Soldier and Unit Performance Enhancement- Proper soldier-machine interface is receiving increased emphasis not only in the design and development of our equipment, but also during the concept formulation and technology development stages. Soldier-machine interface technologies will improve training, expand individual capabilities and make it easier to operate sophisticated equipment. Robotics, expert systems and artificial intelligence will reduce the workload, enhance the performance of human operators and reduce the number of required operators. Computer generated imagery and display technology for more realistic mission simulators and embedded training technology are but two of the advanced technologies contributing to rapid training advancements.

Our 6.1 basic research program supports both theoretical and experimental research by Army laboratories, industrial laboratories and over 200 universities. These universities and labs are the birthplace of the emerging, high leverage technologies of the future. This year's budget includes the University Research Initiative (URI) for ten scientific areas vital to our Army of Excellence. This is part of a DoD-wide competitive program initiated in FY86 with U.S. universities. The successes of our Centers of Excellence for Rotary-Wing Aircraft Technology at Georgia Institute of Technology, University of Maryland and Rensselaer Polytechnical Institute prove the mutual benefits of this program to the Army, industry, universities and the nation. The URI program stimulates fundamental research vital to the Army, provides a valuable pool of high technology expertise, speeds the infusion of emerging technologies from academia to industry, promotes a stronger university/Army laboratory interface and produces scientists and engineers educated in disciplines critical to the Army. The URI addresses ten vital technology areas: manufacturing science; reliability and maintainability technology; electro-optics; signal processing and image understanding; advanced propulsion systems; geosciences; fast reaction kinetics; intelligent control systems; high frequency microelectronics; ultra dynamic performance materials; biosystems and biotechnology and advanced construction technology.

MEDICAL RESEARCH

Together with modern battlefield weapons systems, the soldier must be considered a "System" and, as the operator, is the most vulnerable and critical component in the array of battlefield systems. The Army medical research and development program is geared to address performance degradation factors that could make this system inoperable or cause it to operate at reduced efficiency due to physical, psychological, or disease-related stresses in a variety of climates and hostile environments, both in peacetime and during periods of hostilities.

Many of the normal, daily hazards to the soldier come from sources such as blast overpressure from artillery, combustion fumes from explosions, and radiation from laser, microwave, and radar systems. Army Medical Research addresses these environmental and occupational hazards.

Advances are also being made to aid the soldier in dealing with natural stresses. These include heat, cold, altitude, sleep deprivation, exhaustion, and the psychological strain of the battlefield. Our personnel are more likely to become casualties from infectious diseases that have decimated military forces during past wars than from any manmade weapon system. Exploiting high payoff technological opportunities in development of drugs, vaccines, and devices for the diagnosis, prevention and treatment of communicable diseases is crucial for success in this area. Monoclonal antibody productions, genetic engineering, novel drug delivery systems, immune enhancement and biomicrosensor development are being actively pursued.

Recent advances in biotechnology are being utilized to speed the process of vaccine development. A notable accomplishment in this area was the development of a vaccine against falciparum malaria. This strategy is being applied to develop vaccines against other parasitic diseases to include African sleeping sickness and leishmaniasis. Recombinant DNA and monoclonal antibody techniques are being used to prepare diagnostic reagents field kits for use in rapid identification of BW agents and natural diseases in the field.

Ribavirin, an anti-viral drug was found to have a curative effect against Korean and Argentinian hemorrhagic fever viruses. A recombinant Rift Valley fever vaccine was found to be very effective in animals.

During periods of hostilities, the soldier may be incapacitated or at reduced efficiency due to the effects of chemical, nuclear, or biological weapons. In support of the soldier on the modern battlefield, new techniques in disease prevention, self-treatment, patient management, resuscitation, and decontamination have been and are being developed. The cyanide antidotes, sodium nitrite and sodium thiosulfate were repackaged and included into the chemical treatment set at battalion aid stations. A prototype vital signs and heart rate monitor has been developed. we have completed operational testing on a prototype patient wrap. Development was completed on a prototype individual soldier resuscitator. We also initiated a soldier performance battery testing with pyridostigmine.

Improved treatment of combat casualties requires earlier diagnosis and treatment of hypovolemic shock. In addition to improved resuscitative fluids, drugs that may "buy time" until adequate volume replacement can be effected are under investigation.

Research aimed at reducing mortality and morbidity due to head missile wounds is a high priority. Improved management of burn wounds is sought through improved dressings, skin substitutes, and epithelial growth systems.

Combat medical materiel items being developed include field production of oxygen and medical grade IV water, field medical refrigerator, heated patient liner for the transportation of casualties, and wheeled litter carrier.

Research in the area of combat dentistry currently includes the following major efforts: the development of synthetic, biodegradable implant materials to replace missing facial bone segments that will accelerate wound healing and simplify final surgical reconstruction; completed advanced development and field testing of a computer-aided post-mortem identification (CAPMI) system; sucessfully laboratory tested a second prototype light-weight hand-held field dental x-ray.

Research in stresses to the soldier-operator produced by materiel systems, battlefield environments, and natural environmental extremes has resulted in a data base and performance criteria for acute mountain sickness. We also conducted field testing of the Combat Feeding System, the largest test ever undertaken of a military field feeding system.

Anticipated FY87 efforts include: field testing vaccines such as malaria, Korean and Argentinian hemorrhagic fever viruses, Rift Valley fever virus, salmonella-shigella (dysentery) vaccine,and anti-malarial drugs. We plan to test prototypes of on-site oxygen generation systems, resusciatative fluid production systems and a high capacity x-ray system. Other efforts will include work on: pharmacological intervention of soldier performance to include jet lag, fatigue and sleep reversal. Futher efforts include: work/rest cycle, family/individual/soldier cohesion, development of artificial skin and a blood preservation system.

Furthermore the following are also planned for FY87: field testing of CAPMI; clinical trials of wound dressings; preparation of sustained time release microencapsulated antibiotics for prevention of wound infection; oral pyridostigmine; production of a patient wrap; a full scale production of chemical warfare agent decontamination resin; and development of a second generation nerve agent pre-treatment and antidotes.

These accomplishments are merely a few of the highlights of an extremely complex and broad research effort encompassing all aspects ofpotential hazards to the soldier, the crucial "system" on the technologically complex modern battlefield.

STRATEGIC DEFENSE

Since the 23 March 1983, speech by the President in which he announced the goal of eliminating the threat posed by ballistic missiles, a program called the Strategic Defense Initiative (SDI) has been established. The SDI, under the centralized management of the Strategic Defense Initiative Organization (SDIO), Office of the Secretary of Defense, is charged with pursuing technologies for defense against ballistic missiles. Emphasis in the program is being given to non-nuclear weapons for defense. The funds for this critical research program are controlled by SDIO and allocated to the Services for execution on a task basis. The Army portion of the SDI has been in being for more than 25 years and received renewed interest and direction with the formation of the U.S. Army Strategic Defense Command (USASDC) on 1 July 1985. The Commanding General, USASDC, acts as the single point of contact in the Army for SDI matters.

After the Congressionally directed termination of the Army-developed BMD SAFEGUARD system in 1975, the U.S. has not had a deployed BMD SYSTEM. However, a continuing R&D program in BMD technology verification and functional experiments has evolved. It promises new technologies and refined system concepts to provide reduced risk and technically advanced options for consideration for future full-scale development. The potential for highly effective defensive systems has never been greater. New systems concepts possess potential for countering attacking ballistic missiles in all phases of their trajectories. Progress has been dramatic in expanding and advancing the technology base from which these future BMD systems will evolve. As a result, the program is in a position to make substantial contributions to the Strategic Defense Initiative technology efforts.

The Army strategic defense program has been conducting R&D aimed at increasing the capabilities and effectiveness of defensive systems for over 25 years. Because of these efforts, the Army has established a highly experienced BMD organization with an extensive technical data base. The Army is therefore uniquely capable to support the Strategic Defense Initiative through early demonstrations of defense capabilities.

Major program thrusts are aimed at demonstrating system and subsystem concepts and developing the mature technologies necessary to support them. Significant effort will be put into defense definition, experiments of aircraft mounted optical sensor adjuncts, terminal imaging radar, advanced radar discrimination, and nonnuclear kill interceptors. Nonnuclear Kill (NNK) mechanisms both within the atmosphere (Endoatmospheric NNK) and outside the earth's atmosphere (Exoatmospheric NNK) and outside the earth's atmosphere (ExoatmosphericNNK) are the major thrust of the program. In addition, experiments will proceed on a terminal defense radar, command, control communication/battle management (C3/BM) system, and data processor. Advanced technology work, to expand the base from which new systems will evolve, will continue on a broad front, including research on directed energy and kinetic energy weapon technologies, advanced sensors, battle management, data processing and discrimination missiles.

Systems concepts being examined include endoatmospheric and exoatmospheric defenses. The integration of these into a multi-tiered defense in depth provides a logical and evolutionary growth path for BMD to a wide range of future options to counter a continued buildup of the Soviet threat in both quantity and quality. These options provide the flexibility required for the various potential BMD missions. For example, a defense in depth could provide protection to critical military and industrial installations and other high value targets. By pursuing a broadly based effort, the BMD program maintains the flexibility to provide defense options for many different applications and thus support the President's goal of eliminating the threat posed by ballistic missiles.

The BMD program also operates the Kwajalein Missile Range (KMR) as a national range. The simultaneous use of KMR for both strategic offensive and defensive program testing provides a unique opportunity to collect realistic data vital to both efforts. The ability of the BMD program to observe and analyze development and operational ICBM firings allows cost savings in the tens of millions of dollars yearly. Kwajalein is the only range in the free world that can accommodate full-scale ICBM tests and provide sophisticated data collection for the terminal and midcourse portions of the trajectory. KMR is a unique national resource, utilized by the Services, NASA and other government agencies.

The Army Strategic Defense Program, through its broadly-based R&D efforts, seeks to develop multi-tiered defense capabilities and conductearly demonstrations of critical defense components. The development of nonnuclear kill systems will continue to receive high priority. The BMD program, by building on the existing infrastructure and emphasizinge volutionary development, is able to accomplish these goals and offer a wide range of options for the defense of the country.

CLOSE COMBAT

The Close Combat mission area relates to weapons and equipment which are used to bring direct, line-of-sight fire upon the enemy. The soldiers who fill this role are often referred to as "frontline troops" and their job is to close with and destroy the enemy. To do so, they must be well led, well trained, and provided with the equipment that will give them an edge over their adversaries. The next several paragraphs will describe those close combat equipment systems for which we are requesting funds in the FY87 budget.

Frontline troops require close combat systems

The main offensive and defensive ground weapon of both the US and Soviet ground armies is the tank. In a combined arms role, tanks can dominate the battlefield, spearheading the offensive, killing other tanks, devastating "soft" targets, and driving through defensive positions with massive momentum. Equally adept on the defensive, the tank provides a ground commander with unequalled capability to counter enemy offensive ground weapon systems. The tank is essential to success on the modern battlefield. The Army's main battle tank, the Abrams, is the most powerful, mobile, and survivable combat vehicle we have ever fielded, and we believe that it can outperform any other tank on the battlefield.

The M1 Abrams—Main power of the battlefield

M1 Abrams

Agility

The agility of a tank is a major element in determining its effectiveness and survivability on the battlefield. A 1500-horsepower turbine engine supplies the Abrams with double the power of its diesel-powered predecessor, the M60. Coupled with an improved suspension system, its agility is unsurpassed by any tank in the world today. Its stabilized sighting system ensures that speed is combined with accurate firepower.

Accuracy

Tankers are able to routinely hit 5-foot targets over a mile away while moving rapidly cross-country. This kind of shoot-on-the-move accuracy is made possible by design features of the fire control and improved suspension systems. The gunner puts his sight on the target and finds the range using a laser rangefinder; a computer automatically determines the ballistic data and adjusts the lay of the main gun; the gunner need only squeeze the trigger to hit the target.

Shooting-On-The-Move

Survivability

The future battlefield will be thick with antitank weapons. Therefore, the Abrams is protected by advanced armor. This, plus its low silhouette and agility, increases its survivability on the battlefield. If the tank is penetrated, a number of revolutionary safety features greatly enhance the survivability of the crew and the vehicle. These include an automatic fire detection and extinguishing system and armored compartments that separate the fuel tanks and main gun ammunition from the crew. The Abrams' passive thermal imaging system allows location of targets at night and through dust, haze, fog, and smoke without disclosing the tank's position. Initial delivery of the product improved M1 the M1A1s began in August 1985. The M1A1 incorporates the German-designed, US-manufactured 120mm smoothbore gun, improved NBC protection system and improved armor. The addition of the 120mm gun will insure that US tanks can keep pace with improvements in Soviet armor expected in the late 1980's and beyond. The major advantages of the 120mm gun system are greater kill capability and growth potential to meet advanced armor threats.

A proven performer

The soldiers' appraisal of the M1 can be summed up in one word—winner! They found the M1 Abrams easier to maintain than the M60 tank and able to shoot more accurately while moving cross-country at high speed. The Army has fielded 32 battalion equivalents. A North Carolina National Guard Armored Battalion (a 2d Armored Division round-out battalion) has received its tanks underscoring our commitment to modernize the reserve components. The FY87 budget provides for 840 M1A1 Abrams Tanks. We have produced 3,056 Abrams tanks as of 31 December 1985.

M60A3—Still a capable tank

The M60A3, a product improved M60 tank, is still a formidable tank. It is a quality tank that will continue to see service into the 1990's because we cannot afford to replace our entire fleet of M60 series tanks with the Abrams. The M60A3 model incorporates a laser rangefinder and a ballistic computer for accurate ranging and improved fire control solutions, and a thermal sight that gives the crew an improved capability to detect targets in darkness and on an obscured battlefield. In FY87 upgrade of the M60A3 will continue with the incorporation of applique armor and an automatic fire supression system to improve survivability.

M60A3

Bradley Fighting Vehicle

The Bradley Fighting Vehicles

The history of modern warfare has vividly demonstrated that tanks are critical to success on the battle-field. Operating independently, however, they are vulnerable to antitank fires from enemy infantry. Therefore, mechanized infantry must be combined with tanks to assure a blend of maneuver forces that will provide the flexibility necessary to defeat any threat. The Bradley Fighting Vehicle is an ideal partner for the Abrams. This vehicle has two configurations, the Infantry Fighting Vehicle (IFV) and the Cavalry Fighting Vehicle (CFV).

The Bradley Fighting Vehicle provides vastly improved cross-country mobility, firepower, and armored protection to the mechanized infantry squad. In intense combat situations, the tank-infantry force must be supported on the move by continuousand accurate fire. The primary weapon of the IFV is a stabilized, dual-fed 25mm automatic cannon. The commander or gunner can instantly select either high-explosive or armor-piercing rounds. The high-explosive round can destroy unarmored ground targets out to 2500 meters, while the armor-piercing rounds are capable of penetrating and defeating the Soviet BMP. The two-man turret also has a two-tube TOW missile launcher and a 7.62mm coaxial machinegun. The TOW gives each squad the capability to engage enemy tanks at long range from overwatch (protected) positions.

The IFV has vision blocks, through which members of the squad it transports can view the battlefield and direct fire from their modified M-16 rifles through individual firing ports. This permits continuous observation of, and contact with, the enemy while on the move. Once outside the vehicle, troops can move toward the objective supported by a high volume of firepower from the vehicle's other weapons.

The CFV is identical to the IFV except for minor modifications for crew size and equipment. The CFV carries a five-man scout squad and provides the cross-country mobility and mounted firepower necessary for armored cavalry and battalion scout squads to carry out reconnaissance, security, and economy-of-force operations.

M2-3 Bradley Fighting Vehicle

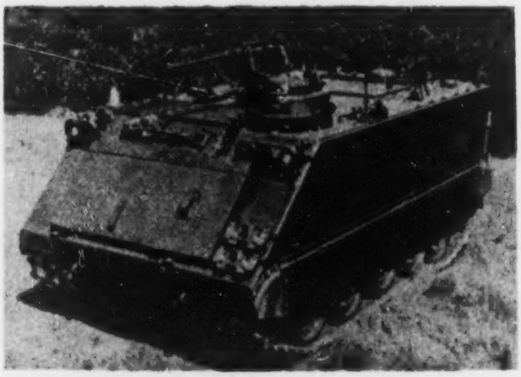
Both the IFV and CFV have an inherent swimming capability and are air transportable in either the C-141 or C-5A aircraft. These fighting vehicles match the highway and cross-country mobility of the Abrams tank. Furthermore, they provide soldiers significant protection from enemy small caliber weapons, heavy machine guns, artillery airbursts and antipersonnel mines. A thermal night sight insures that this potent weapon system maintains its capability during night operations. No fighting vehicle available in the world today matches the all-around capabilities provided by the Bradley.

Bradley: Demonstrated all-around capabilities

The first Bradley production vehicle was delivered to the Army in May 1981. Today, we are producing the Bradley at a rate in excess of 50 vehicles per month. The first mechanized infantrybattalion was equipped in March 1983 at Fort Hood, Texas, and the first European battalion was equipped in September 1983. The North Carolina National Guard has also received six CFV's. As of 31 January 1986, 2142 Bradleys have been accepted by the Army. Seventeen battalion equivalents have been fielded. The FY87 budget supports the production of 870 Bradley vehicles in the BFVS-A1 configuration. This vehicle includes the TOW-2 system, a tank killing armament, which allows the Bradley to shoot through obscurants while counteracting jamming.

Like the Abrams tank, the Bradley is a winner in the view of the soldiers who use it. It provides them a capability they have never had on the battlefield before. The Bradley is a superb fighting system today which can be made even better by product improving it like we do all our systems. The Army is currently developing a series of survivability improvements to make it even better.

The M113 family of vehicles continues to serve the Army in a variety of combat, combat support, and combat service support roles. The Army has begun survivability modifications to enhance the capability of this fleet into the 1990's. Improvements include spall suppression liners which decrease the spray of shrapnel in the event of vehicle penetration. Additional improvements are armored external fuel tanks, improvements to the power train and provisions for add-on armor kits to increase protection levels for the crew. The powertrain improvements increase reliability and maintainability while providing the power increase needed to assure adequate agility and mobility on the battlefield.



M113 Armored Personnel Carrier

M113

Another variant of the M113 vehicle family is the M577 Command Post Vehicle which provides command and control facilities for both forward maneuver and support forces. It features a raised top deck section that permits stand-up work within the carrier and an auxillary power unit to permit operation with the main engine shut down. The FY87 budget will procure 300 new M577'sagainst existing shortages.

Attack helicopters continue to be a key element of our Army's combat capability. They provide our forces with a highly mobile, long range, day/night lethal antiarmor fire capability, coupled with the anti-materiel, antipersonnel effect of cannon and 2.75-inch rockets. The attack helicopter was first used in combat in Southeast Asia where it proved to be a great asset to our light infantry forces.

Attack Helicopter's inherent mobility

Because of its inherent mobility, attack helicopters will play a major role in any situation that requires our forces to react quickly. They can strategically deploy to reinforce Europe or respond to other contingency requirements; they can fly rapidly across a wide front to areas that cannot be reached easily by ground mobile forces and they provide a significant advantage in target-rich environments where exploitation is feasible. In Europe, a ground attack on our forces will be spearheaded by masses of armored vehicles. Soviet doctrine stresses building overwhelming momentum with blitzkrieg-like tactics. Frontages mandate that we concentrate on their main avenue of approach and quickly counter their armored thrusts. No other weapon system offers the combination of high movement rates, freedom of the tyranny of terrain, and long-range point target destruction capability, around the clock, even during adverse weather conditions like that of the attack helicopter.

AH-64 Attack Helicopter

The large number of attack helicopters that the Soviets have fielded in recent years shows that their leaders share our belief that the attack helicopter will play a vital role in any future land battle. The importance of attack helicopters, and the recognition of Cobra/TOW performance limitations, led to the development and procurement of the Apache Attack Helicopter (AH-64). The Apache represents a significant increase in performance, firepower, and survivability when compared with its predecessor—the AH-1S Cobra. More important, the Apache provides the Army a mobile, lethal antitank capability that can be quickly deployed worldwide to areas of strategic concern. Apache's ability to operate worldwide over a broad spectrum of environments may be the difference between success or failure.

Appache Attack Helicopter: An all-environment performer

The powerful, two-engine Apache has been designed from the start to perform anywhere in the world under the most demanding conditions of altitude and climate. Its agility enables pilots to take advantage of the terrain, vegetation, and even buildings to avoid detection. A target acquisition/designation sight (TADS) and pilot night vision sensor (PNVS) enable the crew to navigate and attack in darkness, bad weather and on an obscured battlefield.

Survivable

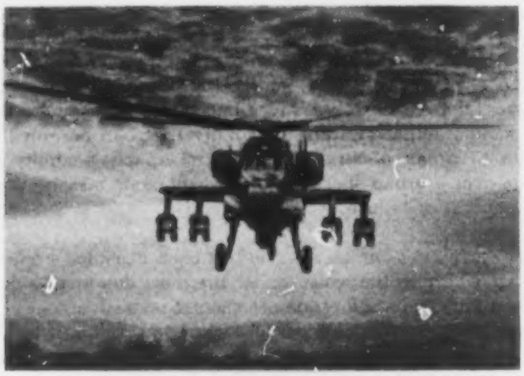
Apache carries a formidable array of weaponry. The main armament is the Hellfire, a third-generation antiarmor missile. Apache's other armament includes the 30mm chain gun and Hydra 70 multi-purpose submunition rockets, which are lethal against a wide variety of targets and complement the antiarmor Hellfire missiles. The Apache's performance characteristics, coupled with survivability features such as armor protection, redundant controls, and electronic countermeasures equipment, make it one of the most survivable systems on the battlefield. A total of 67 Apaches have been delivered to the Army as of 31 December 1985. Training of pilots and maintenance personnel is underway to support fielding of the first Apache unit during the spring of 1986. The FY87 budget provides for procurement of 144 Apache helicopters at the economic rate of 12 per month.

Cobra/TOW: Effective but limited

Like the M60 series tank, the AH-1 Cobra helicopter has been continually upgraded to improve its operational capabilities, safety, and survivability. While these improvements will contribute to its effectiveness and survivability against armor, the Cobra is currently a daytime helicopter with limited aircraft performance capability when operating in a characteristically hot Middle Eastern environment. To correct the night-fighting shortfall, approximately 500 Cobras, will be modified with a Forward-Looking Infrared System (FLIR) to provide a night target engagement capability. The FY87 budget also funds other improvements and continues the Cobra Fleet Life Extension (C-FLEX) program. The C-FLEX program will enable the Cobra to continue in use beyond the year 2000.

Scout Helicopters

The use of scout helicopters to seek and select targets enables attack helicopters to conserve fuel and ordnance, and allows the commander to concentrate his antitank capability at critical points. Upon acquiring targets, the scouts position the attack helicopters, determine the distribution of fires, laser designate targets for the Hellfire missile, and coordinate artillery fires throughout the battle area. During the battle, scouts provide real-time battlefield information relating to the enemy situation and targets destroyed.



Apache with Hellfire

Additionally, the scout is a responsive system to refine intelligence from other sources and integrate all forms of firepower against the target.

The Army Helicopter Improvement Program (AHIP) upgrades part of the scout fleet into an improved observation helicopter. Engine performance and rotor improvements make the AHIP better able to operate on hot days and at high altitude. The mast- mounted sight incorporates a laser designator and a forward looking, infrared capability for night and adverse weather operations. This mast mounted sight allows the helicopter to remain masked behind the terrain with only the sight exposed. In addition to the employment of conventional artillery the AHIP has the capability of acquiring and designating targets for Copperhead and other Army or Air Force precision guided munitions.

AH-1S Cobra/TOW

Army Helicopter Improvement Program

The AHIP program, based upon modification of an existing light observation aircraft, complies with Congressional guidance and shows significant savings when compared with a new airframe development program. Advanced procurement funding in FY86 and procurement funds in FY87 will provide for the conversion of 48 aircraft in FY87.

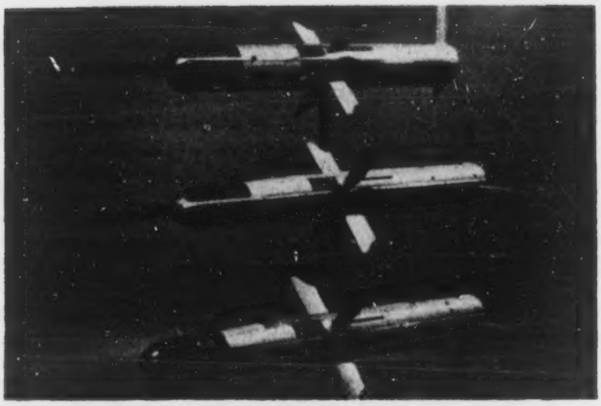
The TOW missile system, which is found on the AH-1S Cobra, the Bradley Vehicles, Improved TOW vehicles, the HMMWV, and with the dismounted infantry, is the most powerful antitank weapon used by ground units. This long-range (3750 meters) antiarmor system is a prime example of evolutionary development. First fielded in the late 1960's, the TOW has been improved to keep pace with the evolving Soviet tank threat. The latest improvement, designated TOW 2, will give the weapon an even more lethal 6-inch warhead, greater speed to reduce vulnerability, and improved guidance and electro-optical countermeasures for an obscured battlefield environment. Deliveries of TOW 2 began in 1983 and it was deployed to Europe in October 1984. Fielding is now complete in Europe, Korea and Panama. FY 87 funds will be used to procure TOW 2 missiles and launcher modifications.

Army Helicopter Improvement Program

The Swedish AT4, type classified M136 on 11 Sep 85, will replace the 1958 vintage M72 LAW. The AT4 provides the dismounted soldier with a lightweight, one shot munition that will enable him to effectively engage a variety of hard targets on the battlefield. This proliferable system will not require a dedicated gunner and will be issued to personnel as needed for mission accomplishment. The AT4 allows the soldier to engage and defeat targets at significantly greater ranges with a higher probability of kill than the current M72A3 LAW. The weapon is also being procured by the Marine Corps and the Navy.

Squad Automatic Weapon

The Squad Automatic Weapon (SAW) is a lightweight, manportable weapon capable of delivering a heavy volume of effective fire up to a range of 800 meters. It provides increased range, volume of fire, and better penetration than the M16A1 rifle which it replaces as the squad automatic



TOW-2, Improved TOW, Basic TOW (Top to bottom)

Squad Automatic Weapon

weapon. The fielding of this weapon will provide a significant increase in overall squad firepower.

Mortars

The mortar, although an indirect fire weapon, is included in the close combat mission area since it is used by forward combat units. The Army is replacing the present 81mm mortars with an improved 81mm mortar which incorporates a British manufactured mortar barrel and bipod mount and a US base plate and sight. It will fire an improved high-explosive round that will accommodate a multioption fuze and achieve extended range, increased accuracy, and higher lethality. Improved smoke and illumination projectiles are also under development. The FY87 request is for 450 systems. The Army will also replace the aged 4.2 inch mortars with the 120mm mortar. The 120mm mortars will be at the battalion level in mechanized, armored and motorized divisions. First unit equipped is expected to occur in 2nd quarter FY87.

Mark 19

The Mark 19 Mod 3, 40mm automatic grenade launcher fires antipersonnel and anti-light-armor grenades to a maximum effective range of 1600 meters. The MK19-3 will be used in the main battle area by infantry units, and by combat support and combat service support units to conduct rear area security missions. It replaces selected M2 (.50 caliber) and M60 (7.62mm) machineguns and will be mounted on ground mounts and on Army vehicles such as the High Mobility Multi-purpose Wheeled Vehicle (HMMWV).

Night vision devices will allow battle operations in the dark

Nightfall will no longer curtail battle activities. Because of advanced night vision devices, night will simply mean a slightly altered environment to soldiers in a future war. This is possible through the Army's use of two different types of night vision equipment: image intensifiers and forward looking infrared imagers. The latter is also referred to as "FLIR" or "thermal imaging".

Systems incorporate thermal imaging for night activities

Image intensifiers see in darkness by amplifying the dim starlight and moonlight reflected from an object. The image intensification devices are lightweight and provide excellent resolution while "seeing" in the dark. These devices are for the individual soldier as well as the wheeled and tracked combat vehicle. The AN/AVS-6 and AN/PVS-5 are night vision goggles for aviators and ground soldiers. The night vision device for the M16 and M60 machinegun is the AN/PVS-4 and the AN/TVS-5 is designed for the M2 (.50 cal) machinegun. The AN/VVS-2, Drivers Viewer, gives the tracked vehicle driver a greater mobility capability, while driving at night.

Another family of night vision devices is thermal imaging. By sensing the temperature difference between an object and its surroundings, these devices allow the soldier to "see" through darkness, smoke, haze, fog, and battlefield obscurants to recognize and identify targets. The Army systems incorporating thermal technology include a family of manportable systems consisting of the AN/TAS-4A, TOW Night Sight; AN/TAS-5, Dragon Night Tracker; and AN/TAS-6, Night Observation Device Long Range (NODLR). The M60A3 and M1 tanks incorporate the AN/VSG-2 and TIS, respectively, for gunner and commander use. The AH-64 APACHE attack helicopter uses the TADS/PNVS for fire control and pilot's night vision. The Bradley fighting vehicle also incorporates a FLIR in its integrated sight unit.

The Army's technology in night vision devices clearly leads that of Warsaw Pact Nations; however, the gap is closing. Therefore, we must continue technology efforts towards developing newer generation devices so that we can use darkness to our advantage on the future battlefield.

The Advanced Antitank Weapon System-Medium (AAWS-M) will be a manportable weapon employed by dismounted infantry at the platoon level to defeat current and future Soviet advanced armor. The system will provide

Advanced Antitank Weapon System

a high probability of kill in all realistic battlefield environments and in the presence of electronic/electro-optical countermeasures. The AAWS-M, which will replace the DRAGON system, will be developed to address the deficiencies of that system and will possess the growth potential to counter evolving armor threats. The AAWS-M will have a weight of no more than 45 pounds and an effective range of 2KM or more under day or night conditions. The tactical system will consist of a round (missile and throwaway launch tube) and a reusable command and launch unit (CLU). Increased gunner survivability will be a primary employment consideration. The system soft launch capability will enable firing from protected fighting positions; an all-environment sighting/surveillance capability coupled with extended range will enable the targets to be engaged earlier than DRAGON, thereby improving gunner survivability.

The next section on fire support mission area discusses how those frontline soldiers are supported.

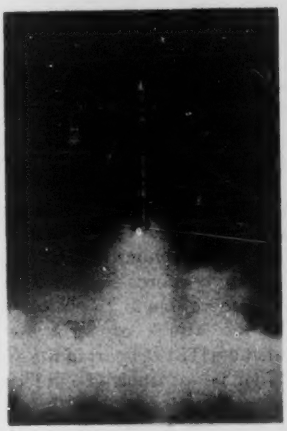
FIRE SUPPORT

The Fire Support mission area includes those systems that are used primarily to generate indirect firepower. The systems in this mission area include not only conventional, nuclear, and chemical firepower provided by cannons, rockets, and missile systems, but also the target acquisition and fire control elements integral to field artillery systems. This section will address the Army's longest range systems first and then will discuss direct support artillery weapons, fire control, target acquisition systems, and finally ammunition developments.

Soviet doctrine emphasizes the use of echelonment in depth. Warsaw Pact forces attack with successive waves of forces, massing as necessary through the use of mechanized armament systems to achieve victory. We must, therefore, be able to strike early and strike deep with great accuracy and massive firepower. We must also be capable of attacking enemy units up to the forward edge of our own troop positions with concentrated, accurate, and readily available firepower.

Soviets attack in depth

The Soviet's early use of their own artillery will make this task even more



Pershing II

difficult. Their doctrine stresses the use of concentrated artillery fire in coordination with blitzkrieg-like maneuver of troops. The Soviets greatly outnumber us in artillery and have the potential to strike our positions with massive amounts of indirect fires. To preclude this, our own field artillery must be able to neutralize their indirect fire systems through effective counterfire.

Pershing II achieves surgical accuracy

The Army's most powerful weapon is the Pershing II, which has more than twice the range of the existing Pershing Ia and far better accuracy. It employs radar area correlation to achieve its pinpoint accuracy. Radar "pictures" of the target area are put into the onboard missile computer prior to launch. As the reentry vehicle approaches the general target area, it takes its own radar "pictures" of the terrain, comparing them to the original. By making course corrections until the two pictures coincide, the missile can achieve surgical accuracy. This permits the use of a relatively small nuclear warhead that reduces collateral damage to the minimum. Pershing II is in production and completed deployment in December 1985.

Lance strikes in depth

The Lance missile system, which was fielded in the mid- 1970's, is our current system used to attack second-echelon enemy formations and for delivery of short-to-medium range nuclear fires. Lance can deliver a 1000 pound conventional warhead to a target located over 70 kilometers away. Enemy logistics facilities, air defense sites, and communications centers are prime targets for this warhead.

To improve the conventional capability provided by Lance and to eliminate many of its shortcomings, e.g., slow rate of fire, manpower intensity, limited range, etc., a follow-on program called the Army Tactical Missile System (ATACMS) is being pursued for the late 1980's/early 1990's fielding.

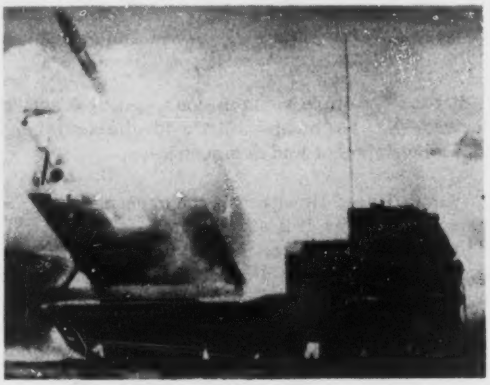
Army TACMS engages indepth battle areas

Army TACMS is an improved conventional ballistic missile system that will be used by the corps commander to destroy, delay, or neutralize enemy forces far beyond the range of cannons and rockets. The corps, by slowing down the enemy's ability to reinforce and support the central battle, can overcome the expected unfavorable force ratio. The requirement for Army TACMS also includes the attack of surface-to-surface missile (SSM) transporter erector launchers (TEL) as part of the anti-tactical missile (ATM) mission. Army TACMS will be transported and launched from the Multiple Launch Rocket System (MLRS) launcher. FY87 funds provide for a continuing development program to lead us to an early Initial Operational Capability (IOC).

While we must be prepared for both nuclear and nonnuclear contingencies, our first response capability must be adequate conventional firepower. As enemy units advance, there may be critical periods when large numbers of targets threaten to overwhelm the capacity of tube artillery. When this happens, we must be able to strike deep with great accuracy and massive firepower, as well as be capable of attacking enemy units up to the forward edge of our troop positions with concentrated, responsive fire.

The Multiple Launch Rocket System (MLRS) is the system that fills this need. It provides the Army with its first multiple rocket artillery capability since World War II. The MLRS rocket warheads contain a large number of improved conventional submunitions which are dispensed from the rocket high over the target and blanket the area with explosives and fragments. These submunitions are devastating against targets such as air defense sites, artillery positions, and troops in the open. The submunitions are also effective against the thin top armor of tanks and other fighting vehicles. The MLRS will be used against concentrations of enemy vehicles, enemy artillery, and as an air defense suppression means.

Multiple Launch Rocket System provides massive and accurate fire power



Multiple Launch Rocket System

The system also has incorporated a number of built-in efficiencies. The rockets are sealed in pods for shipment and require no maintenance after leaving the factory. The MLRS tracked carrier vehicle is a derivative of the Bradley Fighting Vehicle and has the same power train and level of armor protection for the crew's protection. Although normally operated by a three-man crew, in an emergency one soldier can operate the entire system. Devices on the launcher can determine both location and direction, and an on-board computer unit computes fire commands, sets fuzes, and automatically fires the rockets. The vehicle cab is designed so that crew-members can remain in the cab during rocket firing. It also has a positive overpressure system to protect the crew in the cab from exhaust gases during launch. The FY87 Budget is for continuation of the fifth year of a five year multiyear contract of this important new system.

The MLRS was developed by the US in cooperation with Germany, France, the United Kingdom, and Italy. In conjunction with Germany, France, and the United Kingdom, we are pursuing the development of Terminally Guided Warhead (TGW) submunitions. These submunitions will enable the MLRS to attack hard point targets in excess of 30 kilometers from the launcher. The concept calls for a rocket to fly to the kill zone, where the

Terminal Guided Warhead

M198 Howitzer

warhead will dispense multiple submunitions that seek out and destroy enemy hard targets. The FY87 budget will provide the continued funding for TGW component development and demonstration.

M198

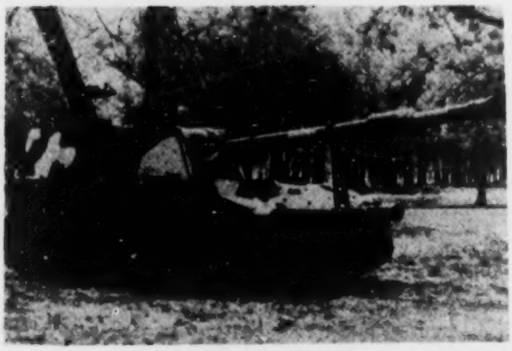
The M198, 155mm Towed Howitzer, is the general support artillery for the non-mechanized divisions. It is also our newest howitzer. It is capable of firing 30 kilometers using a rocket assisted projectile. The M198 provides major increases in range and reliability over its predecessors and may be delivered by parachute or carried by a variety of cargo aircraft and the CH-47 helicopter. The M198 can fire scatterable mines, nuclear rounds, improved conventional munitions (ICM's), conventional high explosives, and Copperhead. Although our budget does not contain M198 procurement funds for this fiscal year, our long-range plan forecasts additional procurements beginning in FY88 and continuing through FY91.

M119 for light divisions

The Army's Light Divisions have a requirement for a lightweight howitzer with increased range and lethality over the existing M102 105mm howitzer The Army has been testing the in-production British Light Gun (L119) and in December 1985, type classified it for procurement as the M119. In 1987, the first year of procurement, 64 units will be purchased. Compared to the M102's range of 11.5KM, the M119 fires conventional HE to 14.3KM and 19.1KM with a Rocket Assisted Projectile (RAP) which is in development. A Dual Purpose Improved Conventional Munition (DPICM) is also being developed for the M119, a munition with a great increase in lethality. Under a licensing agreement with the UK, all UK production will occur, to be followed by co-production and then total on-shore U.S. production. The 105mm howitzer is scheduled to begin fielding in FY88.

Improvements are part of overall modernization

The mechanized and armored portions of our force structure have the M109 self-propelled 155mm howitzer and the M110 8-inch self-propelled howitzer. These weapons date back to the 1960's, but have been improved over the intervening years. We have extended the range of the 155mm howitzer to 24 kilometers and the range of the 8-inch howitzer to 30 kilometers using rocket-assisted projectiles. We are continuing to modify the M109 in order to extend the life of the system to at least the year 2000. In this year's



M109 Howitzer Improvement Program

budget request we have asked for continued funding to procure modification kits that will provide increases in survivability and capability.

We are also conducting research and development of improvements that will provide additional increases in armament reliability and survivability against NBC attack and counterfire, as well as increased responsiveness and reduced crew fatigue. The howitzer improvements are only part of the overall effort leading to modernization of the Artillery System.

G/VLLD

Ground/Vehicle Laser Locator Designator

The Ground/Vehicle Laser Locator Designator (G/VLLD) is used by artillery forward observers. This dual-purpose device is used by a forward observer to determine target ranges precisely and to designate targets for laser-guided projectiles, missiles, or bombs. The G/VLLD achieved its initial operational capability in 1982. The FY87 budget provides for continued procurement. In our armored and mechanized units the Fire Support Team (FIST) requires a mounted vehicular capability. The new Fire Support Team Vehicle (FISTV) will give the FIST armor protection, mobility, and built-in communications which will enable it to operate with fast-moving armor, mechanized infantry, and cavalry units, and be responsive to the maneuver commander.

FISTV: Responsive to commanders

The FISTV represents a combination of new laser improved artillery observer equipment with the proven performance of the M113A2 personnel carrier. The vehicle is very similar in appearance to the Improved TOW Vehicle and incorporates the G/VLLD in an armored, elevated module mounted on an M113A2 chassis. The FISTV is equipped with a north-seeking gyro that provides the directional data needed for accurate artillery fire requests. It can operate in hull defilade with only the elevated G/VLLD module exposed, thereby increasing survivability. The FY87 funding provides for continued procurement of FISTV Modification Kits. The Army plans to convert 178 M113's to FISTV's this year.

The first vehicles were fielded to the 24th Infantry Division in August 1985. The effective management of the enhanced capability we have been describing is an important responsibility of the Field Artillery. Specifically, our artillerymen have the "fire support mission" for the collective employment of mortars, field artillery, air support, naval gunfire, and other lethal and non-lethal (smoke, illumination) attack systems in support of combat operations. To accomplish this mission, fully automated support for planning, coordination, control, and execution of close support, counterfire, interdiction, and air suppression fires is required to maximize our combat power.

Fire Support Team Vehicle (FISTV)

TACFIRE: Severely limited for tomorrow's battlefield

Our Field Artillery Tactical Fire Direction System (TACFIRE), as currently fielded, represents first generation technology that provides automated data processing of technical fire control data, selection of munitions and volume of fire for enhanced target accuracy. However, the requirements for a total fire support package that provides (1) development of targets and delivery of fires; (2) coordination and control of fires and fire support assets; and (3) planning for future operations represent severe limitations for TACFIRE on tomorrow's battlefield. In essence, TACFIRE will not meet the data processing needs of the fire support system for the 1990's and beyond. It also is not economically smart to produce TACFIRE spare parts by mid 1990 because of outdated technology. TACFIRE's replacement, The Advanced Field Artillery Tactical Data System (AFATDS), will significantly broaden and modernize the US Army fire support command, control, and coordination systems. The AFATDS will expand the TACFIRE capabilities with no increase in personnel requirements and will provide automated support for the Fire Support Control Segment of the Army Command and Control System (ACCS) during the 1990-2010 timeframe. Compatibility and interoperability will be provided with all existing and planned US Army Field Artillery Systems to include sensor systems, related NATO systems from the United Kingdom (BATES) and the Federal Republic of Germany (ALDER), the Marine Integrated Fire and Air Support System (MIFASS), and other Functional Control Segment Systems in the command and control architecture.

AFATDS: Expanded automated capabilities

The AFATDS will retain selected systems of the present TACFIRE for total system integration. For example, the related technical system which provides firing data to each individual weapon will be retained. The Fire Support Team and Forward Observer Digital Message Devices will continue to be the "forward entry devices" in AFATDS and are "not" part of the AFATDS funding program.

Lastly, AFATDS represents the Army's first automated program that is truly software driven. Specifically, prior to any final hardware consideration, user requirements must be accurately defined and then translated, through software development, into a DOD higher order level language (Ada). Once the user software is written, then the hardware will be selected. This approach ensures users satisfaction; it maximizes detailed functional definition of the fire support, command, control and coordination requirement; it provides a basis for a market survey for procuring hardware components that is driven by the user requirements.

Target acquisition within the fire support mission area is of equal importance to fire delivery and control systems. The Firefinder system, consisting of AN/TPQ-36 mortar-locating radar and AN/TPQ-37 artillery locating radar, provides our soldiers the ability to automatically detect and locate enemy batteries in realtime and to attack them with timely and accurate counterbattery fire. The final procurement requests for Firefinder were FY81 (AN/TPQ-36) and FY83 (AN/TPQ 37), with the last units scheduled for delivery to the Army from these buys in July 1986 (AN/TPQ 36) and March 1987 (AN/TPQ 37). Plans project completion of fielding in 1988.

The effective use of field artillery weapons depends upon accurate location, direction, and estimates of the influence of the atmosphere on artillery projectiles, rockets, and missiles as they travel to their targets. We now have automated systems to provide these data.

Artillery survey workload reduced

The Position and Azimuth Determining System (PADS) is an automated, self-contained inertial surveying system which provides the field artillery with a secure, all-weather, day/night means for rapid survey control. Surveys that normally take the conventional five-man survey party 12 hours can now be accomplished by a two-man PADS party in less than two hours. The FY87 request will purchase 107 systems which will add to the 360 systems already procured.

Improved accuracy via timely meteorological data

The new Meteorological Data System (MDS) will insure that artillery fires are corrected for changing atmospheric conditions. This is significant since greater ranges of artillery projectiles will cause them to be exposed to atmospheric effects for increased periods of time. Reliable data are also required on how weather will affect electronic warfare and battlefield obscurants employed by the enemy. In a 'dirty battlefield" environment, where anything from a severe storm to chemical or nuclear conditions may prevail, we must have timely meteorological data. The MDS will accurately measure the atmospheric variations and automatically transmit those variations to TACFIRE and other automated systems that compute artillery firing commands.

Ammunition stabilization provides warfare capability

Our ammunition request provides for increased readiness by buying more rounds for artillery for essential modernization by procuring smart munitions such as Copperhead, and for improved sustainability through modernizing old production facilities and increasing explosives and propellants production capability. Each component of the ammunition budget responds to a deficiency in readiness, modernization, or sustainability. The stabilization of the ammunition account is key to providing the warfighting capability we need. Within the Army budget, field artillery ammunition has been allotted the largest portion of our resources for munitions procurement. Major items in this category are 8-inch and 155mm Improved Conventional Munitions, 155mm Area Denial Artillery Munitions and Remote Antiarmor mine system projectiles.

Munitions R&D

Opportunities exist for making our weapons more effective through the use of modern munitions and advanced guidance systems. By making greater use of these technologies we can achieve a significant increase in our conventional capability in a cost-effective and timely fashion. The munitions research and development programs cover all types of conventional munitions from exploratory development through engineering development. Major areas include: technical base programs for large caliber munitions development and ballistics technology work applicable to all systems; development of modernized ammunition for the 105mm howitzers; field artillery munitions such as the Sense and Destroy Armor munition—a top attack, antiarmor submunition employing improved sensing for broad application to weapon systems such as the MLRS and 155mm howitzer; and numerous smaller projects for the development of fuzes and propellants. The FY87 request will allow the Army to continue this critical research and development area.

Copperhead: Dramatic increase in single-shot kill probability

A successful product of munitions research and development is the precision guided projectile known as Copperhead. Until the advent of Copperhead, the field artilleryman faced the statistical probability of wearing out his gun tube before hitting a moving tank. This laser-guided 155mm howitzer projectile changes those odds dramatically. Copperhead is the only deployed field artillery munition with the ability to yield a high probability first round kill against moving hard point targets.

Copperhead

Field Artillery Ammunition Support Vehicle (FAASV)

Copperhead is fired from existing 155mm howitzers. It uses a built-in, semiactive laser seeker which makes it possible for the round to destroy stationary or moving armored and other high value targets, at ranges up to 16 kilometers, with a high single shot kill probability. As the projectile descends toward the intended target, its laser seeker searches for and acquires the reflections of a laser beam. This beam can be projected onto the target by G/VLLD, FISTV, AHIP or Apache helicopters or by a remotely piloted vehicle. The projectile corrects its course through the use of its fins as it "homes" to the laser spot on the target.

Copperhead has been in production since 1981 with over 15,745 rounds produced through FY85. Since July 1982, Copperhead has demonstrated better than 80% reliability. FY87 funding will be used to maintain production at efficient rate while continuing to build up our war reserve inventory.

FAASV

As a part of our modernization effort, we are also looking at improvements in ammunition hauling, handling, and survivability. In FY83 we initiated procurement of the Field Artillery Ammunition Support Vehicle (FAASV), which is equal in mobility to the self-propelled howitzers in our inventory and provides armored protection for both crew and ammunition. FAASV is being procured for deployment in Europe, Korea and select CONUS units. The FY87 request will add 141 FAASVs to the Army inventory.

AIR DEFENSE

The Army's Air Defense mission area includes those activities involved with the detection and engagement of the enemy air threat with ground-to-air gun and missile systems, in coordination with the other combined arms and Air Force interceptor aircraft.

Soviet air threat

Without adequate air defense coverage, ground combat elements, supply lines, command centers, Air Force strike bases and other high-value targets are exposed to destruction by fixed-wing and rotary-wing attack aircraft. Warsaw Pact forces have over 3,600 combat aircraft in Central Europe, including bombers, fighters, and helicopters. Quality and quantity are on the rise. Ground attack aircraft such as Flogger, Fencer, and a new production ground support fighter, combined with the HIND and HAVOC attack helicopters pose a deadly threat to armor and mechanized forces. In addition to the aircraft threat, there is an increasing threat from the growing numbers and types of tactical missiles and air-launched missiles.

Air defense modernization

For many years, short range air defense was provided by Redeye, Vulcan and Chaparral with medium to high altitude air defense provided by HAWK and Nike-Hercules. The Army's current air defense modernization program provides a new mix of systems that will be effective against the growing air threat through the 1990's.

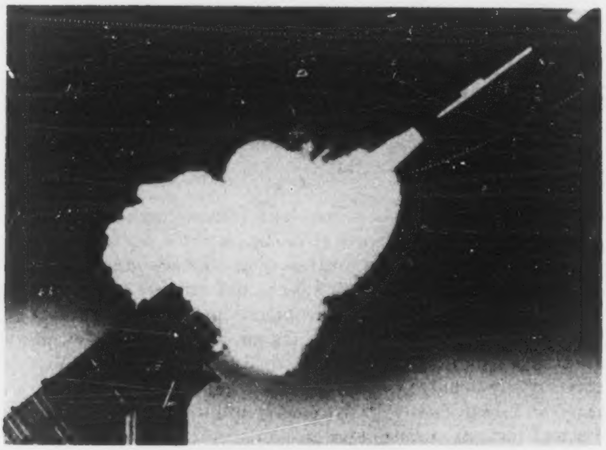
Patriot: A key system

In future wars, we can expect to experience saturation raids by large numbers of sophisticated aircraft employing intense electronic countermeasures. In response to this, we are fielding Patriot as a replacement to Nike-Hercules and improving the HAWK missile system.

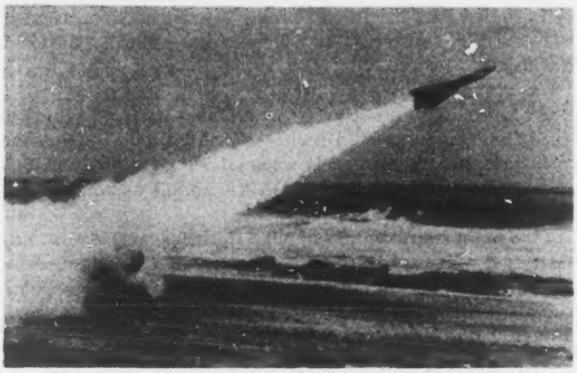
One of the main shortcomings of Nike-Hercules, which was in the force from 1958 to 1985, was that a battery could only engage one target at a time. The operator had to wait until the missile intercepted the target before firing another missile. Patriot, on the other hand, can attack and destroy several enemy targets while simultaneously tracking other targets.

Reduced Manpower

Due to its advanced technology, Patriot is operated with fewer soldiers than its predecessors. Each Patriot launching station contains four ready-to-fire missiles. The missiles, which are sealed in canisters that serve as both shipping containers and launcher tubes, require no field maintenance. Each Patriot battery contains up to eight trailer-mounted launchers that can be



Patriot



I-HAWK

widely dispersed. Communication with the Engagement Control Station is made via secure data link.

Multiple engagement capabilities

Enemy targets can be tracked and prioritized for destruction through the interaction of Patriot's radar and computer. The radar can guide several missiles at the same time, updating priorities as threat aircraft are engaged. Patriot employs a new guidance concept called Track-Via- Missile. As the missile reaches the area of an enemy aircraft, it informs the radar where it is in relation to the target. A computer then makes calculations and directs the missile on a path that insures a kill. Operating modes vary from manual mode to fully automatic mode. The system's two operators always retain full override capability over computer decisions. The Patriot system is currently in production and is being adopted by our NATO allies. The first fully trained and operational battalion was deployed to Europe in early 1985. The second battalion was deployed in September 1985. The FY 87 budget will support the procurement of additional fire units and the continued fielding of the system.

New Guidance concept

The mainstay of the Army's low to medium altitude air defense is the HAWK missile system. Although Patriot will replace some HAWK units, the HAWK force will be retained indefinitely. Ongoing and planned product improvements will upgrade Hawk performance to meet the projected threat through the 1990's. HAWK will have simultaneous engagement capability against close-in saturation attackers, increased detection range, improved reliability, and greater effectiveness against jamming. Twenty-two foreign countries have the system, and procurement interest has been expressed by several others. Part of this worldwide acceptance can be attributed to HAWK's performance in the 1973 Mideast War, where, in its basic configuration, it destroyed more than 20 MiG's and other aircraft. The FY87 budget will continue the product improvement program and will procure replacement rocket motors.

I-HAWK: Upgraded and reliable

The Army-led, Antitactical Missile (ATM) program began in FY83 to develop counters to the growing tactical surface-to- surface missile threat. The program consists of concurrent near-term to long-term approaches to solve counterforce, terminal defense, and battle management problems. Near-term efforts upgrade existing air defense systems to field an early point terminal defense capability against conventional tactical missiles. Mid-term efforts focus on development of counterforce and anti-cruise missile capabilities. The full solution will include both active and passive countermeasures, and will require a combination of systems, including Army TACMS and current Army air defense systems as well as possible new systems, sensors and battle management capability. FY87 funds will provide for research and development work in threat vulnerability, counterforce requirements and terminal defense capability.

The Army is committed, as a top priority, to solve the critical shortfall in air defense for our forward maneuver elements created by the SGT YORK program termination. A Forward Area Air Defense Working Group (FAADWG) has developed a Counter Air Concept using air defense artillery, the other combined arms and the U. S. Air Force to counter the growing air threat. The FAADWG identified an air defense program that integrates weapon systems, sensors and command, control and communications architecture into a system optimized to counter the entire spectrum of the air threat. The FAAD program is a system of major subsystems consisting of a command, control and intelligence subsystem; a non-line of sight weapon; line of sight weapons for the forward and rear of the division; and combined arms initiatives including air-to-air Stinger, improved tank ammunition and potential improvements to the Bradley Fighting Vehicle gun and fire control. Combinations of available air defense weapons and new technologies are being carefully looked at to provide the needed forward air defense. A final list of candidates will be identified and evaluated in FY86/FY87. FY87 funding is essential to the rapid fielding of this integrated air defense program.

The first major element and keystone of the FAAD system is a modern command, control, and intelligence subsystem which will integrate forward air defense weapons into a quick reacting, comprehensive, and lethal arsenal. The Forward Area Air Defense Command and Control and Intelligence (FAAD C2I) subsystem (formerly SHORAD C2) is being developed to provide maximum effectiveness from our forward area air defense weapons. This C2I effort focuses on increasing the probability of successful engagement of hostile targets by insuring rapid, timely acquisition and dissemination of information on the air combat situation.

The present forward area air defense method of accomplishing command and control is totally manual. Weapons control information and sensor data from Air Force and high to medium altitude air defense systems is provided to forward area air defense weapons via voice communications. This information is received at a central control facility at the forward area battalion where it is manually filtered, plotted and retransmitted by voice to the appropriate air defense and ground combat elements. This method is time consuming and limits the probability of successful air defense operations.

The FAAD C2I development will automate and streamline this process to enable us to successfully engage the air threat within the division airspace. Computer processors, graphic displays, control terminals and data links will replace most human actions and voice communications. The new subsystem will provide forward area gunners and commanders with the required data quickly and simply and with responsive, flexible, less restrictive weapons controls. The FY87 funds continue full- scale engineering development of the switching architecture and selection of the ground sensor that is planned to begin in FY86. FY87 will also continue concept development for an aerial sensor.

Tri-service development of "friend or foe" identification system

The intelligence part of FAAD C2I includes the sorting of friendly and hostile aircraft during aerial combat. The ability to positively identify hostile aircraft remains a significant limitation to our air defense forces, particularly for short range air defense weapons which are currently limited to visual aircraft identification and identification friend or foe localized to individual weapons. In the future we expect to be able to operate beyond visual range through our weapons improvement and acquisition programs. Our efforts are focused on noncooperative identification of both hostile and friendly aircraft. Several of these have shown excellent potential in early demonstrations. We are making limited improvements in our current cooperative friendly identification systems and participating in tri-service development of a new cooperative friendly identification system for selected air defense systems.

Improved positive hostile and friendly identification capabilities combined with improved, automated command and control capabilities will maximize the effectiveness of our air defense forces. FY87 funding continues development and testing of improved identification capabilities.

The second subsystem in the Forward Area Air Defense System is the Non-line-of-sight weapon. The weapon is intended to be employed in defilade behind the FLOT and out of range of enemy direct fire systems. This subsystem, will give the Army Air Defense the capability to kill helicopters either hovering behind mask or on the ground. The Fiber Optic Guided Missile (FOG-M) is a candidate for this mission. The FOG-M is a precision guided missile which uses a fiber optic cable to transmit seeker images to the control vehicle and guidance commands to the missile. The weapon is a relatively mature system which has been developed largely by the Army's Missile Command. Alternative concepts for the Non-line-of-sight weapon including a ground launched version of the Advanced Medium Range Air-to-air missile (AMRAAM) are also being investigated. FY87 funding is critical to the early fielding of this part of the Forward Area Air Defense system.

The third component of the FAAD are Line-of-sight-forward weapons which will be used in the close combat zone of both light and heavy forces. These weapons are designed to kill or suppress enemy fixed wing and exposed rotary wing aircraft. A gun/missile mix is contemplated to optimize the strength of both weapon types. In general guns are more cost effective and provide quick reaction high volume fire against the close-in targets. Missiles are more effective against the longer range targets. A request for information has already been released to industry to assist in the preparation of material requirements for the heavy division. Because there are numerous weapons which could potentially perform the LOS-F mission an IOC as early as 1989 is conceivable. However, this is predicated on FY87 funding.

The fourth element of the FAAD system is the Line-of- sight-rear weapon better known as Pedestal Mounted Stinger. This weapon uses the manportable Stinger missile fired from a fire unit mounted on a High Mobility Multipurpose Wheeled Vehicle (HMMWV) and will provide defense for the rear area of the division. Pedestal Mounted Stinger will be procured in FY87 as a non-developmental item based on an FY86/87 evaluation of candidates.

Until the FAAD system is fielded the Army will rely on Stinger, Chaparral, and Vulcan to perform forward air defense.

STINGER

Stinger is the Army's manportable air defense missile system. It provides air defense protection for forward deployed ground combat units. Although Pedestal Mounted Stinger will eventually replace most MANPADS teams, Stinger will continue to be used in its shoulder fired configuration when required. Stinger was developed to replace the aging Redeye system, which was first fielded in the mid-1960's and had limitations when matched against the current and projected enemy air threat. Stinger was deployed to active Army units in Europe in February 1981.

Stinger overcomes many of Redeye's shortcomings with improved range and maneuverability, the ability to attack much faster targets, and, most

STINGER

Chaparral

important, the ability to attack aircraft from any angle. The missile uses a passive infrared seeker. A proportional navigation system enables the Stinger to fly an intercept course to the target. The high-explosive warhead is designed to penetrate the aircraft before exploding in order to insure a kill. These capabilities provide an enormous advantage over the Redeye system, which is a "revenge" or tail-chase system only.

STINGER-POST

Stinger was designed with built-in growth potential. An improved Stinger seeker, Stinger-POST, completed development and a production contract was signed in FY83. This seeker improves Stinger performance in a countermeasure environment. Development of the Reprogrammable Microprocessor (RMP) for the missile began in September 1984. FY87 funding will continue the production of Stinger-POST (RMP).

Chaparral was first fielded in 1969. It will remain in the active inventory through the 1990's. Chaparral is also being provided to the Army National

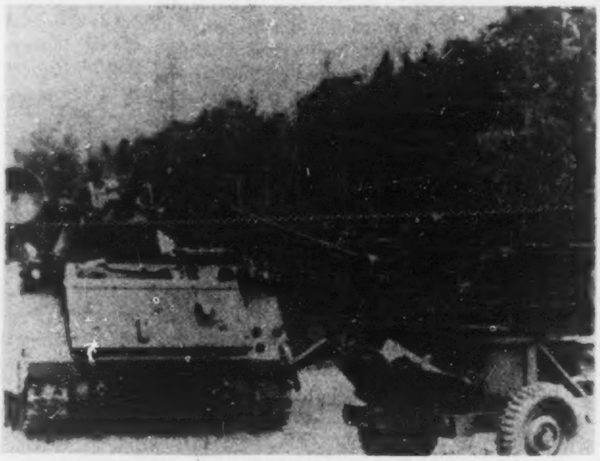
Guard as part of their modernization program with the first battalion fielded in 1985. To keep Chaparral current against the threat's countermeasure capability, a new seeker using Rosette Scan Seeker (RSS) technology started production in FY86 with initial facilitization. The first production buy of new seekers will occur in FY87.

Chaparral: Cost-effective and continually improved

Improvements fielded to date include an improved infrared guidance which provides a forward engagement capability, an Identification Friend or Foe (IFF) System to assist the gunner in identifying friendly aircraft, a smokeless rocket motor that increases survivability by reducing the visible smoke trail when the missile is launched, and a Forward Looking Infrared (FLIR) night sight for improved adverse weather and night target acquisition. Future improvements include adding other modifications to improve system performance, reliability and NBC protection.

The Product Improved Vulcan Air Defense System (PIVADS) was developed to improve tracking and gun pointing accuracies and increase maintainability and availability of the current 20mm Vulcan air defense gun to provide an interim capability. Improvements include the replacement of the present disturbed reticle by a director type sight, the replacement of the analog computer with digital fire control electronics, modification of azimuth and elevation systems to reduce backlash and incorporation of built-in-test equipment. A contract has been signed for 285 PIVADS kits and modification is expected to begin in early 1987.

PIVADS improves tracking and aiming capabilities



Product Improved Vulcan

COMBAT SUPPORT

We are well acquainted with the Soviet employment of massed armor and the formidable threat it poses to our forces. Minefields and other obstacles which are tied to natural terrain features and integrated into the battle plan serve as a significant combat multiplier. Properly integrated minefields and obstacles serve to slow the rate of movement of mechanized forces thus enhancing the effectiveness of our direct and indirect fire systems. They also serve to force the threat to alter his tactical maneuver plans and force the employment of time and resource-intensive breaching systems. The formations become compressed, thus providing greater vulnerability to our armor killing weapons systems. Should the enemy attempt to simply run through the minefields, he will pay a heavy price in tanks. Our modern mine systems have significantly improved lethality. Finally, attempts to avoid the mined area require modification of his maneuver plans at the Operational level. Again, his maneuver rate is slowed and may well force him into other preselected kill zones, disadvantageous terrain or to adopt other less desirable options such as dismounted maneuver.

On the fluid, rapidly changing battlefield of the future, it is imperative that minefields be emplaced as the ebb and flow of the battle dictates. In the past, the emplacement of mines was a slow, laborious and logistically intensive process and the mines had to be emplaced long before the enemy commanders intentions became clear. Our new Family of Scatterable Mines (FASCAM) changes this situation. Our new delivery capabilities significantly improve emplacement time and provide for a more flexible response to changing tactical situations. Additionally, we have attained a new capability with these systems,. We can now employ mines in rear area on key targets such as artillery units, Command and Control centers, logistic complexes, concentrations of armor and routes which may or are being used by reinforcing or counter attacking units.

Minefields help deal with massed armor

The Remote Anti-Armor Mine (RAAM) and the Area Denial Artillery Munition (ADAM) are 155mm artillery delivered mines and are in production. We will continue to provide for RAAM and ADAM procurement in FY87.

The Volcano mine dispensing system will begin procurement in 1987. Volcano is a rapid mine dispensing system with mines loaded into mortar-tube-like canisters which are placed in common dispenser racks for helicopter and ground vehicle use. Volcano initially provides for the urgent need for rapid employment of large tactical minefields in the light forces. In the outyears, the Volcano ground system will replace the GEMSS in heavy forces. The Modular Pack Mine System (MOPMS) will begin production in 1986. The MOPMS is a foot-locker sized module containing 21 mines. The MOPMS replaces the heavy and bulky conventional mines now used as a basic load in combat arms units and will also be used in special mining situations such as closing lanes and gaps in large tactical minefields. MOPMS mines are explosively deployed from the module when a threat arises. Otherwise, the module is retrieved for future use.

The other side of the Mine Warfare picture is our need for countermine equipment. The threat has learned the historical value of mines well and is prepared for the employment of mines during all phases of the battle. We can expect him to fully exploit his extensive mining capability. Our combat units require versatile and effective countermine systems to provide the freedom of maneuver necessary in the AirLand Battle. We are far from having a satisfactory countermine capability in the field, while the Soviets are well equipped in this critical area. Continued procurement of several key countermine systems is supported in the FY 87 budget. The Mine Clearing Line Charge (MICLIC) is an explosive line change which clears a path 8 meters wide and 100 meters long through deliberately placed minefields. The mine clearing roller and plow systems which are mounted on tanks provide flexible and effective breaching equipment in nearly all terrain and weather conditions for the numerous hastily emplaced minefields we will encounter.

As key members of the Combined Arms Team, engineers have the responsibility for providing specialized support to ensure the mobility, countermobility and survivability of the maneuver elements. In the lethal environment of the main battle area, the combat support role of the engineers greatly increases the combat effectiveness of our fighting forces by providing terrain reinforcement, construction of fighting positions and obstacles, breaching barriers, clearing obstacles and preparing bridge crossing sites. Today, this mission is even more critical as the battlefield becomes increasingly mobile.

Armored combat earthmover

Armored Combat Earthmover

The M9 Armored Combat Earthmover (ACE) is uniquely capable of accomplishing mobility, countermobility, and survivability tasks in the forward area of the battlefield. The M9 has the speed and all-terrain mobility to move with the combat force and provide critical support when and where needed. The M9 offers armor protection against artillery fragments and light direct fire weapons as well as operator protection against chemical and biological agents. The M9 is air transportable and air dropable. It can swim, dig, bulldoze, haul, and move with the flow of the battle. The M9 is an essential element of the combined arms team on the highly lethal and mobile AirLand Battlefield.

Chemical threat

Chemical warfare may very well be the Army's most vulnerable area in the 1980's. Even though the US is formally committed to the policy of "no first use" of lethal or incapacitating chemical agents by adherence to the Geneva Protocol of 1925 and seeks a complete and verifiable ban of lethal chemical weapons, the threat to our forces is high. Today, US forces are facing a chemical threat from an adversary that is the best prepared nation in the world in the use of chemical warfare. Without question, the Soviet Union possesses a formidable offensive capability to wage chemical warfare for an extended period and their leadership continues to devote significant resources to research, development, and procurement of more advanced chemical weapons and equipment. They also have a large and well equipped dedicated chemical force. All units within their armies train extensively for chemical warfare.

Stockpile—Aging and inappropriate

Binary concept

Given the disparity between US and Soviet chemical warfare capabilities and evidence of Soviet use of chemical warfare directly or through surrogates, we must promptly modernize our own retaliatory capability. The US currently has a limited stockpile of chemical munitions. All of these munitions are of the unitary design; that is, they contain the actual agent in its final form. These munitions are all over 16 years old, and they are costly to store, maintain in a usable status, and transport in a safe manner. Additionally, the stockpile is composed of weapons and agents that are inadequate and in some cases inappropriate for the modern battlefield. The best option for developing and insuring a credible retaliatory stockpile in support of the national policy of deterrence is binary modernization. The binary concept uses two separated nonlethal chemical components that combine during the flight to the target to form a lethal chemical agent. In addition to the added safety and flexibility afforded by binary munitions during production, storage, and movement, binary modernization will allow us to update weapon and agent mix. An R&D effort is underway to apply binary technology to rocket warheads.

The Congress, recognizing the need to modernize the chemical weapons stockpile, appropriated $23.15 million in FY81 for construction and facilitization of the Integrated Binary Production Facility at Pine Bluff Arsenal, Arkansas, to allow for future production of the 155mm GB-2 (nonpersistent) artillery round. Initial construction began in October 1981, and was completed in December 1984. The Army FY87 program includes funds for procurement of 155mm projectiles. Also, the Army ammunition production base in the FY86 program provides for facilities to produce Bigeye Bombs in support of Navy and Air Force procurements.

Chemical protection equipment

In addition to modernizing the chemical weapons stockpile, we must continue the procurement of chemical protective equipment in FY87 to improve the ability of our forces to survive an initial chemical attack. More procurement, research, and development are required before we can sustain combat operations in a chemically and biologically contaminated environment. A new protective mask providing improved protection and a simplified collective protection system for use by tactical units will continue to be procured in FY 87. Also, collective protection systems will continue to be integrated into our command, control and communications systems and combat vehicles.

The FY87 chemical-biological program continues our efforts with universities and industry to broaden the technology base required to support materiel needs and to develop improved chemical-biological defense materiel. Development will be completed on numerous collective protection equipment for shelters, vans, and vehicles. Chemical- biological agent detection and alarms development will continue on a remote sensing alarm, an automatic chemical agent detector and alarm, and an automatic liquid agent alarm. Development of a mechanized NBC reconnaissance vehicle was initiated in FY 85. Work will also continue on improved decontamination systems including non-aqueous decontamination systems for tactical vehicles and equipment, and a dual purpose system that will be capable of making smoke for battlefield obscuration decontaminating equipment exposed to chemical-biological agents.

Nuclear artillery projectiles have provided part of the US nuclear deterrent for the past 30 years. Currently fielded nuclear artillery projectiles, which incorporate 1950's era technology, must be replaced to assure continued reliability and effectiveness. Modernization programs are underway. We are currently completing procurement of the 8-inch nuclear artillery projectile and development of the improved 155mm nuclear projectile is continuing. These nuclear artillery projectile programs will provide a Short-Range Nuclear Force (SNF) that will continue to provide a credible nuclear deterrent by assuring the collective survivability of NATO SNF and enhancing the survivability of our conventional firepower.

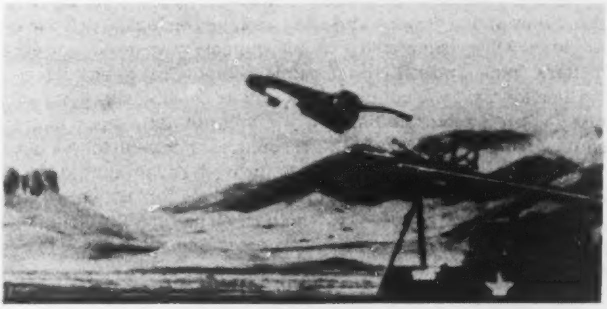
Deep reconnaissance capabilities

Today's battlefield requires the commander to be able to look over the next hill out to 300 kilometers deep into the enemy's rear. The commander must be able to acquire data necessary to assess the situation, target a threat force and execute real time operations continuously and simultaneously to interdict threat forces. Unmanned aerial vehicles (UAVs) have the potential to improve the commander's ability to accomplish these tasks. UAVs have the capability to fulfill important battlefield functions: target designation and artillery adjustment; reconnaissance, surveillance, and target acquisition; attack; command, control and communications; air defense early warning; psychological operations; deception and provide meteorological data. Based on the combat-oriented functions, the Army has defined three categories for its family of UAVs: TADARS, General Purpose and Expendable. The Army has defined two current members of the UAV family: the general purpose Corps Intelligence Electronic Warfare (IEW) UAV and TADARS Aquila.

The Army has defined the requirements and a non-development item (NDI) acquisition approach for the Corps IEW UAV, which will be started in FY86 and FY87.

RPV fills need for timely intelligence

The Aquila is a militarized system designed to perform target designation, artillery adjustment and laser designation in a high intensity combat electronic warfare environment. The Aquila can fly above key enemy zones in order to gain required data when the defensive strength of the enemy is likely to make manned reconnaissance extremely risky.



RPV

The Aquila Full Scale Development (FSD) flight testing started in July 1982. Since then more than 278 flights have been flown with an overall success rate of 92%. The system has experienced technical performance problems. In recent tests, paid for by the contractor, launch, recovery, navigation, telemetry of TV video, jinking, 3-hour endurance, long-range hand-off between ground control stations and laser designation for Copperhead against both stationary and moving targets have all been successfully demonstrated. FY86 RDTE funds will support continuation of developmental and operational tests, continuation of development of the FLIR night vision sensor.FY87 RDTE funds will complete operational testing of Aquila and continue FLIR development. Aquila procurement will begin in FY87 with acquisition of an increment of the training base.

Joint Tactical Fusion Program

Modern sensor systems are capable of providing massive volumes of raw intelligence data. In order to be of use to the tactical commander, the collected data must be correlated, integrated, and interpreted with minimal delay. The manual processes now employed in the analysis of tactical intelligence information are inadequate to cope with the volume of collected data in sufficient time to satisfy the commander's needs. This is particularly true in an AirLand Battle, Deep Attack environment, where effective employment of new weapons systems depends on timely and accurate information on enemy activity. The Joint Tactical Fusion Program will remedy this situation through the introduction of automated tactical intelligence fusion systems for the Army and Air Force. The Army system, the All Source Analysis System (ASAS), will provide automated assistance to intelligence processing (fusion) and will also support related areas such as target development, collection and mission management of intelligence and electronic warfare systems, and operations security. The Enemy Situation Correlation Element (ENSCE) will perform similar functions for the Air Force and is being developed concurrently with the All Source Analysis System. Maximum commonality in hardware and software is planned between the Army and Air Force systems to ensure that the ground and air commanders share a common perception of the enemy situation. Current plans call for fielding of baseline fusion systems beginning in the mid- 1980's. These systems will undergo evolutionary development leading to the fielding of objective systems in the early 1990s.FY87 RDTE dollars will complete the design of the large intelligence processing and communications interface modules, type classify the analyst workstation, deliver intelligence processing software for PACAF/USAFE computers and develop the first software release ASAS/ENSCE. FY87 OPA dollars will procure limited capability configuration ASAS for the USA Intelligence School, and two divisions.

JOINT STARS permits quick reaction battlefield management

The Joint Surveillance and Target Attack Radar System (JOINT STARS) will provide wide area surveillance of the battlefield. It will have both a moving and a fixed target capability permitting detection and location of targets such as fixed and moving vehicles, command posts, assembly areas, and low-flying helicopters and fixed-wing aircraft. JOINT STARS will broadcast simultaneously to multiple ground stations at division and corps, and will be integrated with the All-Source Analysis Center and the Advanced Field Artillery Tactical Data System to provide both battlefield management and quick- reaction, realtime targeting. Operational effectiveness will be enhanced by cueing from other sensors. In FY87 the Army will provide the initial ground station modules for fielding to Europe.

Offensive electronic warfare

Offensive electronic warfare operations are calculated to disrupt enemy command, control, and communications capa- bilities. Every unit is tied by an electronic apron string to its next higher echelon. Disrupting the Soviets' communications network by means of electronic warfare may be a key means of slowing a Warsaw Pact attack by precluding the timely massing of forces and thereby making it vulnerable to eventual defeat. The commander of a force needs to know what the enemy is doing. One way he can get this information is by intercepting and locating enemy emitters. Army systems to provide location and intercept of communications and radar emitters are mounted in aircraft and in wheeled or tracked vehicles. TRAILBLAZER and TEAMPACK systems, which are currently being fielded, are ground-based systems whose targets are, respectively, communications and radar signals. Fielded airborne systems are GUARDRAIL and QUICKLOOK which are being upgraded through product improvements.

Guardrail

Quick Look II

Guardrail V is a combined airborne sensor and ground processing facility communication intelligence system with proven ability to provide near-realtime data on the location of enemy electronic emitters. Guardrail, in the RU-21H platform, has some limitations such as an unpressurized aircraft and limited frequency coverage. Thus, we are continuing the procurement of the Improved Guardrail (RC-12D), a system that corrects those limitations.

Countering electronic emitters

Quick Fix is an airborne offensive communications intercept, location and jamming system that will deny the enemy the use of his radios during key periods of battle. It does this by intercepting and jamming enemy communications. Quick Fix is designed to operate against air defense units and maneuver units. Quick Fix I is currently employed in a modified EH-1H aircraft. Future Quick Fix II systems will be mounted in the EH-60A BlackHawk aircraft.

Jamming enemy communications

Quick Look II is an airborne, computer-controlled system mounted in a Mohawk aircraft that detects, locates, and identifies enemy radars. It provides tactical field commanders with timely data on enemy missile, artillery, and antiaircraft weapons. The FY86 budget contained limited funds for product improvements to the aircraft and includes RDTE funds to support the consolidation of Guardrail and Quicklook into a single platform. Procurement funds start in FY88.

Radar emitters

In the area of ground-based communications jammers, our Combat Electronic Warfare Intelligence (CEWI) units will be equipped with the medium-power AN/TLQ-17A, TRAFFIC JAM, and the high-power AN/MLQ-34, TACJAM. In addition, the Army is developing a family of low-power, expendable jammers that are designed for hand emplacement or delivery by artillery projectiles. Procurement of the hand-emplaced jammers began in FY84. The Army is also equipping Combat Electronic Warfare Intelligence (CEWI) units with the PIRANHA radio electronic countermeasures set, OG-181. This device allows us to use our AN/VRC-12 series tactical radios as jammers and provides an ECM training capability to both the active and reserve forces.

COMBAT SERVICE SUPPORT

In the initial stages of most potential conflicts, we can expect to fight outnumbered and outgunned. Therefore, the commander must have the ability to move forces rapidly about the battlefield in order to optimize their overall effectiveness and to avoid decisive engagements with forces having superior strength. The key to this capability is enhanced mobility, both air and ground, which enables us to position our forces in the right place at the right time. The Combat Service Support major mission area is an aggregation of mission areas designed to provide the commander support to the weapons systems, support systems, and their operators and crews.

UH-1: a good, but limited performer

The Blackhawk helicopter, the high end of the high-low utility helicopter mix, will perform air assault, air resupply and aeromedical evacuation missions, and answers the Army's need for improved battlefield mobility. Its predecessor, the UH-1, is an excellent and reliable helicopter, but is power-limited so that during hot weather and in high-altitude conditions, its payload is greatly reduced. Furthermore, in Vietnam we learned that we must reduce the vulnerability of future helicopters to small arms ground fire.

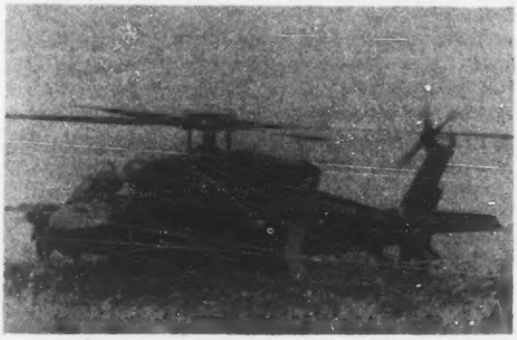
UH-60 Blackhawk

Blackhawk: a versatile aircraft

The UH-60A Blackhawk is clearly superior to the UH-1. It can carry more than twice the UH-1 payload and can transport a complete, fully equipped squad faster in most weather and altitude conditions. Blackhawk also adds significantly to the mobility of the division by having the capability to reposition equipment such as the 105mm howitzer, its crew of six, and up to 30 rounds of ammunition in a single lift.

Survivable

The critical components in the Blackhawk are either armored or redundant to enable it to withstand multiple small arms hits. Tests have demonstrated its ability to continue flight for a minimum of 30 minutes after sustaining damage from projectiles as large as the 23mm high-explosive incendiary round. The airframe is designed to absorb impact forces by progressively deforming on impact, thereby protecting the crew in a crash. The Army's experience in Grenada with the Blackhawk proved the aircraft to be very survivable.



Blackhawk

The Blackhawk has been fielded in Korea, WESTCOM, Panama, Europe and FORSCOM units. Fielding to ARNG, USAR, USAREUR Medevac and FORSCOM units are in process and will be followed by a continuation of fielding to FORSCOM units.

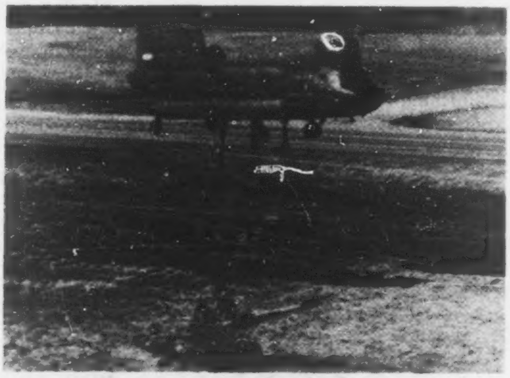
Stabilized production rate

Successful multi-year contracting

The Blackhawk is presently being procured under a second multiyear contract (FY85-87), which has significantly stabilized the production base and produced substantial savings to the Government. FY86, the first year of the FY86-FY88 T700 series multiyear contract, included procurement of engines for the Army's UH-60 Blackhawk, AH-64 Apache, EH60 Quick Fix, Navy's SHG-60B SeaHawk and a number of other Navy programs. This highly successful program is its second multiyear contract and has resulted in significant savings to the Army. The program continues toward meeting the procurement objective of 1107 Blackhawks. The Army has accepted 700 Blackhawks as of November 1985. The Army is requesting 78 Blackhawks in FY87.

The CH-47 Chinook is the Army's medium-lift helicopter. Designed in the 1950's and fielded in 1962, the CH-47's primary missions are movement of ammunition, repair parts, petroleum and tactical movement of artillery, troops and special weapons on the battlefield. In 1975 a modernization program was approved to upgrade the CH-47 A, B, and C models into a new D model configuration. These improvements extended the useful life of the fleet beyond the year 2000.

CH-47: Army's workhorse



CH-47D Modification Program

Modernization includes new fiberglass rotor blades, transmission and drive system, modularized hydraulics, electrical systems, advanced flight controls, triple hook cargo system and an auxiliary power unit. These efforts greatly enhance reliability, maintainability, productivity, survivability and safety of the medium-lift fleet.

Initial operational capability was achieved on schedule in February 1984 at Fort Campbell, Kentucky. The benefits of this program to the operational units have been demonstrated by an average of 77 percent full mission capability rate (goal 70%) during the past year.

The FY 1987 budget will fund the seventh year of this effort and the third year of 48 aircraft-per-year multiyear procurement. This program continues to be a stable program with deliveries on schedule and on cost. By 31 January 1986 there will be 99 CH-47D aircraft in the field.

Truck Shortage

While other elements are essential to rapid resupply and mobility, tactical wheeled vehicles have been and will remain the backbone of our logistical system. They are vital to the fielding of new weapon systems and tactical operations Army-wide. We have a planned program to acquire tactical trucks over time to meet these needs; to fill shortages; and replace over-age, obsolete and less capable vehicles.

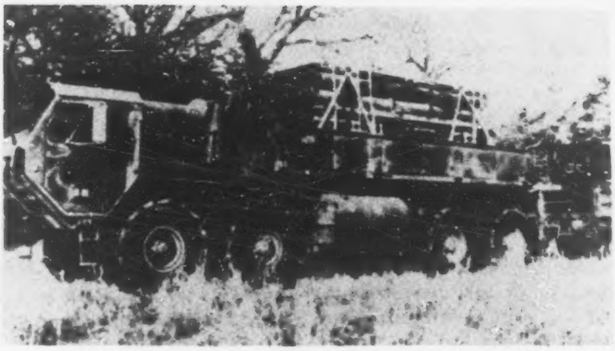
5-Ton Truck

5-Ton Trucks for new systems and to replace over-age fleet

Heading the list of workhorses is the 5-Ton Truck. It supports the introduction of such major systems as the Patriot, Pershing II, and TACFIRE, as well as meeting ammunition, general cargo transport, and other special-pur-pose needs. In FY81, a competitively awarded 5-year multi-year contract was signed with AM General Corporation for 11,394 product improved 5-Ton Trucks, with an option to increase production by 100%. To meet critical Army requirements, as well as other Services' requirements, the options have been exercised. A competitive 5 year multiyear procurement will be awarded 3QFY86. As of December 1985, over 13,500 new 5-ton trucks have been accepted by the Army. Additionally, in 1987, we will begin prototype evaluation of a Family of Medium Tactical Vehicles to replace the 2 1/2 and 5-ton fleets that will be lighter and more air transportable, mobile, and fuel efficient. We plan to begin buying this new truck in the early 1990's.

10-Ton Trucks for MLRS, GLCM, and Pershing II

The Army 10-Ton Heavy Expanded Mobility Tactical Truck (HEMTT) is a vehicle that features an assemblage of commercial components. The HEMTT meets high-priority systems requirements, such as Patriot, Multiple Launch Rocket System, and tactical unit ammunition and fuel transport requirements. A competitively awarded five-year multiyear contract was signed with Oshkosh Truck Corporation in FY81. In FY87 we will continue to acquire 1523 HEMTT vehicles from the current contractor. In addition, FY 87 will be the second year of an evaluation of a follow-on Family of Heavy Tactical Vehicles which will be a follow-on to the current 10-ton HEMTT. This family will incorporate the productivity enhancements of the self-loading/unloading capabilities of a Palletized Loading System.



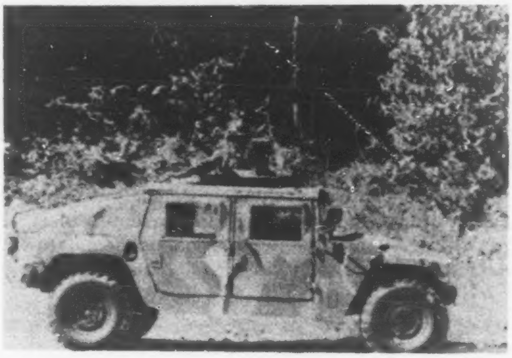
10-Ton HEMTT

Utility Vehicles needed

Heavy tactical wheeled vehicles are critical for the transport of heavy cargo, fuel, and ammunition, but light-load requirements dictate the need for utility trucks. Historically, this need was satisfied by the M880, commercial pickup truck series of vehicles and to some extent by the M151 1/4-ton with a 1/4-ton trailer and M561 Gama Goat, 5/4 ton. We are now beginning to fill this light-load or 5/4-ton payload requirement by two vehicle families. The first vehicle family is the Commercial Utility and Cargo Vehicle (CUCV), which serves the needs of the Army, Marine Corps, Air Force and Navy.

Commercially available, adapt-able vehicles

The CUCV program complies with congressional direction to commercialize at least 20 percent of the M151 1/4-ton jeep fleet. Fielding of CUCV's started in September 1983. FY85 was the last year of the 4-year multiyear procurement. Over 50,000 CUCVs have been fielded.



HMMWV

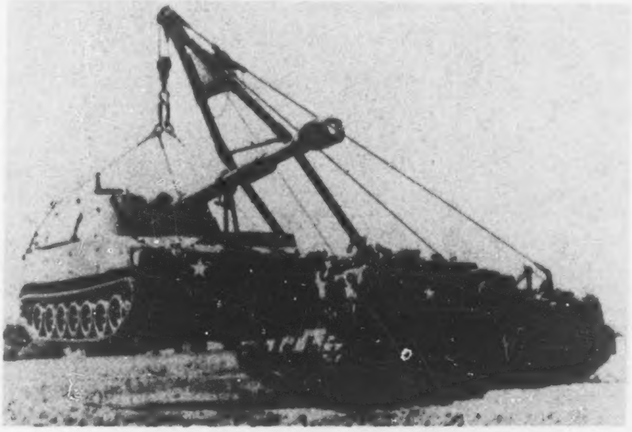
HMMWV: asset in creating lighter divisions

The other vehicle family in the 5/4-ton-payload category, is the High Mobility Multipurpose Wheeled Vehicle (HMMWV), which is complementary to the CUCV. The HMMWV is a 5/4-ton-payload, diesel-powered, four-wheel-drive tactical vehicle that uses a common chassis with six body configurations: TOW weapons carrier, utility, ambulance, squad carrier, shelter carrier, and Stinger weapon carrier. Emphasizing the use of commercially available components, the versatile HMMWV has excellent on-and off-road capability, with a range of 300 miles. This vehicle will replace aging and obsolete vehicles in the light tactical fleet: the M561 GAMA GOAT, the M274 MULE, and M151 1/4-ton utility vehicles not replaced by the CUCV. It will perform in command and control, utility, forward observer, forward air control, and numerous other battlefield roles. This vehicle is one of our most important assets as we move toward lighter divisions. The tri-service HMMWV program also allows the Services to take advantage of the commercial production base. The FY87 budget includes money for 12,842 HMMWVs.

Our challenge for the future is to maintain the stability of our program funding to meet existing, critical truck needs. The introduction of the families of vehicles concept will meet these needs with the operational and logistic benefits of commonality. An additional and important consideration is the logistics standardization that occurs among all the Services as a result of multiyear buys of common-use tactical vehicles. It's good for industry and good for the Armed Services.

Armored recovery vehicle supports quantitative strength

Rounding out our combat service support transport requirement is the M88A1 recovery vehicle. The M88A1 supports the mechanized and armored combat soldier by recovering disabled tanks and other tracked combat vehicles from the battlefield.



M-88A1 Recovery Vehicle

Fielding of the M88A1 was initiated in 1977. A depot program to overhaul 863 gasoline-driven M88's and to convert them to diesel power was completed in FY82. Production of the M88A1 is scheduled to continue through FY86. The FY87 budget provides funding to develop and procure product improvements to the M88A1. These product improvements will upgrade the M88A1 to provide it with the capability to fully support the M60A3, M1, and M1A1 tank fleets.

Logistical support equipment gives our soldiers the vital support they need to fight successfully in sustained conflicts. In FY87, we will place greater emphasis on logistics research and development to enhance the operational capability, reduce the maintenance burden and extend mission reliability of our equipment. Logistics research and development and logistics support equipment requires continued support.

Now that we have reviewed the mission areas that put combat power on the battlefield and sustain it in battle, we shall turn to the mission area that is essential for orderly execution of all battlefield missions—command, control, and communications.

COMMAND, CONTROL AND COMMUNICATIONS

The command and control of our forces, and the communications which make it possible, are the keys to success on the battlefield. The C3 function is analogous to the central nervous system of the body. The weapons and support systems discussed earlier are similar to muscles which react only on command and which function effectively only when they are controlled and coordinated. The systems discussed in the C3 mission area provide the means by which we control, direct, and coordinate our forces. The importance of these systems cannot be overstated.

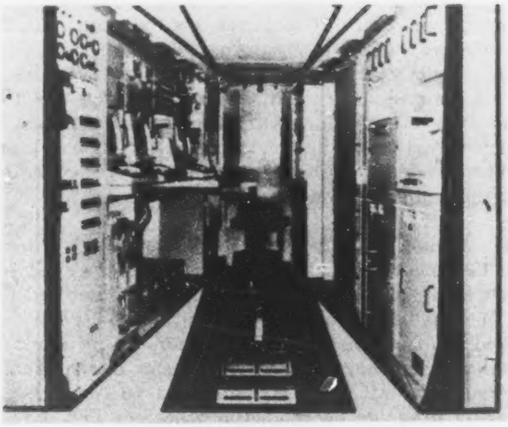
Enormous demands and challenges

The C3 mission area encompasses a staggering variety of demands and challenges. The demands range from a derivative of the Presidential "Hot Line," down to a simple squad radio capable of functioning under the rigors of combat. The challenges relate to an almost unbelievable number of conditions and complications. C3 systems are affected by natural and man-made interference and they are subject to enemy interruption, direction finding and jamming. Many C3 systems must be compatible with the sophistication of fixed site operations in peacetime and provide mobile capability during hostilities. In addition, C3 systems must usually be compatible and interoperable with our sister Services and NATO allies.

Communications technology is a field in which the US possesses a degree of expertise that is the envy of the world. Due to affordability constraints, however, the Army's C3 equipment has not kept pace with this technology advantage. The situation is getting better because of the increased emphasis on C3 at all levels and the many modernization initiatives being pursued. With your support we will close the technology gap during the decade of the 1980's and will move from an era of grease pencils and manual switchboards to one in which the readiness of the Army's C3 systems will be significantly improved by the systems we will now discuss.

TRI-TAC

The Army recently reassessed its communications architecture to insure that it was purchasing the correct mix of equipment to efficiently and effectively meet its battlefield needs. The major program included in this review was the Joint Tactical Communications (TRI-TAC) program, a Joint Service and DoD program to develop and field tactical multichannel switched communications. The broad goals of the TRI-TAC program are to achieve interoperability between Army and other DOD telecommunications systems, provide new equipment that reflects the most recent technology, eliminate duplication in development among the Services, and enhance interoperability with NATO systems.



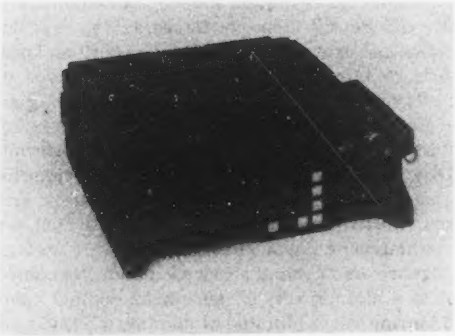
TRI-TAC

Analog to digital communications

The TRI-TAC family of equipment consists of Mobile Subscriber Equipment (MSE), automated digital telephone and message switches, secure and nonsecure telephones, multichannel radio transmission equipment, automated control facilities, tactical data and facsimile terminals, and other associated items. This equipment is urgently needed to replace the obsolete, nonsecure, manpower-intensive, manual communications equipment currently in the field.

The MSE is the most important communications system in the FY87 request; it provides corps and division commanders with the secure, flexible, mobile communications needed for command and control on the modern battlefield. This year's request procures equipment for the first operational corps and division units which will be located at Ft Hood, Texas. The MSE acquisition is an example of an innovative approach which shortens the acquisition cycle by using a nondevelopmental strategy. It is based on a willingness to take advantage of existing, proven technology and developments by our NATO allies rather than trying to develop the "ultimate" system. It enables the Army to avoid millions in development costs and start fielding a capability in 1988 rather than in the mid- 1990's.

The FY87 request provides funding for continued software development for various TRI-TAC items and the procurement of transmission equipment, unit level switches, automated control facilities, and various voice and data terminal devices together with associated communications security equipment.



SINCGARS

SINCGARS: reliable radio system for the soldier

The Army does not presently have a tactical net radio system capable of operating in an electronic countermeasure environment. The Single Channel Ground and Airborne Radio System, (SINCGARS) will give the soldier a reliable, jam-resistant, secure combat net radio system capable of operating on the move and compatible with current vehicular radios and associated communications security equipment. The FY87 budget request continues the production of this urgently needed combat radio.

PLRS

Knowing where we are—PLRS a combat necessity

Any future conflict will require combat commanders to rapidly and precisely locate and identify their own forces, as well as other friendly units, on a highly mobile and extended battlefield. The Position Location Reporting System (PLRS), a joint program with the US Marine Corps, will give us that capability. It is cryptosecure, highly resistant to jamming and can be used in all weather and terrain. In the future, PLRS will be integrated with the Joint Tactical Information Distribution System (JTIDS) terminal to form the Army Data Distribution System (ADDS). It will provide the Army with a reliable, jam resistant, data communications, navigation, and identification system for use in the five primary functional areas which require C3 on the battlefield: maneuver control, fire support, air defense, electronic warfare/intelligence, and combat service support. We consider attainment of this capability a high priority for successful combat operations. Hence, the Army and Marine Corps initiated production of PLRS under a multiyear production contract in FY83 which will result in initial system fielding of PLRS for the Army in 1987.

For the Army, the PLRS production contract establishes a production base for the follow-on ADDS system. Hence, the FY87 request also provides for continued production of ADDS through modification of PLRS production equipment and initial procurement of JTIDS. This request will result in initial system fielding of ADDS in 1988.

Maneuver Control System

The commander must be able to aggregate volumes of information emanating from many sources in the form of reports, staff estimates, plans and orders. An automated command and control (C2) system is needed to provide a comprehensive, timely picture of the battlefield to support the decision making process. The Maneuver Control System (MCS) is such a system; it is a combination of computer hardware and C2 software that gives the tactical commander quick access to near real-time battlefield information. The MCS is the maneuver and force level control system within the Army Command and Control System (ACCS). As such it will be compatible and interoperable with the other control nodes for Air Defense, Fire Support, Intelligence and Electronic Warfare, and Combat Service Support. Critical elements of information from all the ACCS nodes will be instantly available to the force commander. Once a decision is made, MCS automates the preparation and distribution of orders to subordinate units for execution. A key feature of the program is its evolutionary implementation that began with an initial maneuver control capability in Europe in FY81. Both MCS software and hardware have evolved according to pre-planned, time-phased steps, guided by field user feedback from numerous exercises in Europe. Over the next several years, MCS evolution will continue. The hardware configuration will evolve into a mix of fully militarized equipment for use in critical locations and and severely stressed environments, and nondevelopmental items (NDI) employed in less critical locations and less severe environments. The MCS will achieve initial operating capability in 4th quarter FY86.

Maneuver Control System

Tactical Satellite Communication (TACSATCOM) systems support the ground mobile forces of the Army, Navy, Air Force, and Marine Corps by providing reliable and effective communications between widely dispersed and rapidly moving forces. Each of the systems uses a communications satellite as a relay station between terminals. Terrain is therefore less of a constraint for employment of TACSATCOM systems than for regular terrestrial systems.

TACSATCOM

Presently, one multichannel system and two single-channel systems are being fielded. The single-channel systems operate in the ultra high frequency range. Production of the single-channel Special Communications System, AN/MSC-64 which provides secure command and control communications from the National Command Authority to special weapons units worldwide was completed in 1983. The FY87 requests provides for completion of a super high frequency single channel receiver upgrade to improve the system survivability. Deliveries of a UHF manpack began in January 1984. The FY87 request will continue procurement of UHF manpack satellite terminals for use by Special Forces and Rangers. The Multichannel Initial System, AN/TSC-93A and AN/TSC-85A, provides tactical satellite communications down to brigade level. Production deliveries of these terminals commenced in FY85. Production of our anti-jam control modem to provide ECCM protection for this multichannel system also began in FY85.

Ground station to brigade level and below

To meet the severe Electronic Warfare (EW) threat and potential nuclear warfare environment of the future, a single-channel Extremely High Frequency (EHF) system will be fielded. The Single Channel Objective Tactical Terminal (SCOTT) system will provide such a jam-resistant, survivable satellite communication link. Advanced development was completed in 1983. SCOTT is the Army and other services ground terminal in the MILSTAR Satellite Communications System. During FY85, the Scott program was restructured to complete engineering development with the

SCOTT meets electronic warfare threat

goal of minimizing cost, schedule and technical risks. The FY87 request continues this development.

DSCS

The Defense Satellite Communications System (DSCS) is a worldwide military satellite communications system which supports the Worldwide Military Command and Control System (WWMCCS), the Diplomatic Telecommunications System, and tactical/strategic C3I requirements of the Military Departments. It is the only capability in existence to satisfy strategically critical wideband command, control, and intelligence communications.

The DSCS is a joint program with the Air Force responsible for the space segment and the Army for the ground subsystem. In the past few years, the Army has initiated upgrade and modernization efforts that will result in the development, procurement, and worldwide installation of a new generation of large, medium, and small satellite terminals. These terminals will be equipped with digital communications and antijam equipment. A new automated system that will control the DSCS satellites communications payload in orbit, as well as communications that pass through the satellite, is being developed. The FY87 request supports these modernization and survivability programs.

NAVSTAR GPS: a common reference system for all services worldwide

The NAVSTAR Global Positioning System (GPS) is a satellite-based radio position navigation system that provides users with rapid data about position, velocity, and time. When fully deployed, the system will consist of 18 satellites and thousands of user terminals.

The GPS employment includes units that normally operate at great distances from their home bases, such as cavalry, pathfinders, and Special Forces, as well as selected users to include all Army aircraft throughout the theater Army. It will also serve as an "initializer" for other position/navigation systems.

The joint GPS Program Office is staffed by Army, Navy, Air Force and NATO personnel, with the Air Force as lead. The Army is participating in the joint development of a family of manpack, vehicular, and aircraft user terminals. Testing of the first Army user terminals began in 1984.

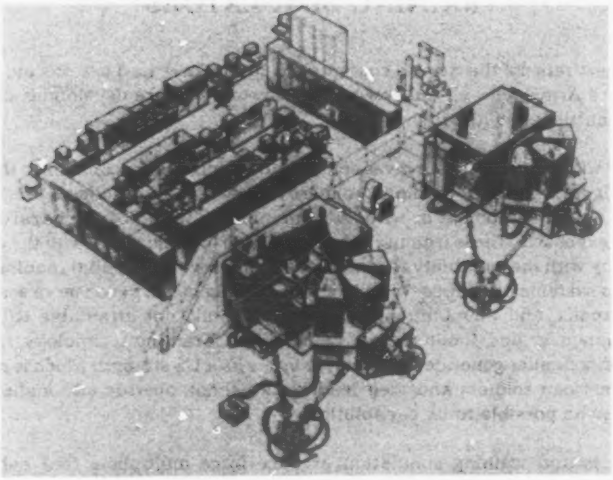
TRAINING SIMULATORS

The FY87 request reflects the Army's commitment to the increased use of simulators. We are aware that a future Army, with all the new weapon systems we are developing, cannot train to fight on the next battlefield without them.

While training with real equipment gives soldiers and their leaders confidence that it will work in combat, training with simulators allows soldiers to repetitively practice techniques which, if performed on the actual equipment or with live ammunition, would be too hazardous, too time-consuming, or too expensive. These training devices are used in conjunction with the actual systems to provide the Army with the capability to maintain and improve the combat readiness of soldiers, crews and weapon systems, to reduce training and operating costs, to conserve scarce resources such as fuel, weapons, and ammunition, and to teach skills not attainable with operational equipment (i.e., maneuver and shoot without being killed). Training technology, much of which employs video disc, computer-generated imagery, or lasers, is a US strength which is being exploited to ensure that American soldiers and their leaders can shoot, operate and maintain their new equipment as close as possible to its capabilities.

Training devices and training simulation produce force multipliers that enhance combat effectiveness at a lower cost. The combat effectiveness of Army personnel is key to both compensating for the numerical superiority of opposing forces and for maintaining a ready force. This combat effectiveness can best be achieved by innovative, efficient, and results-oriented training. The major thrust in the development of new training devices is to develop equipment that allows a high transfer of knowledge and experience from the training situation.

The Army's past investments in research and development of training devices are now paying off as numerous devices enter or continue into production and deployment. Among these devices are the Remoted Target System, which is the target mechanism component of the Army's Range Modernization Program; the Army Training Battle Simulation System, which is a computer driven war game for combined arms operations training of battalion level commanders and staffs; the Unit Conduct of Fire Trainer, which is a gunnery trainer for Abrams Tank and Bradley Fighting Vehicle crewmembers; the Multiple Integrated Laser Engagement System (MILES), which is a family of eye-safe laser devices that are attached to weapons to realistically simulate the firing capabilities of rifles, machine guns, and other direct fire weapons. The MILES will instantly simulate the casualty-producing effects of direct fire weapons providing a capability to conduct force-on-force tactical engagement simulation field exercises with enhanced realism and feedback to teach lessons heretofore learned only in actual combat. Other simulators just as important to train soldiers are the Air Ground Engagement System, which is MILES for aircraft and air defense weapon systems, and Flight Simulators, such as the Combat Mission Simulator for the AH-64.



Flight Simulator Complex.

This budget reflects the Army's commitment to provide realistic tactical engagement training to the combined arms by funding efforts to simulate indirect fire and expand MILES use to more types of weapon systems. Fielding MILES for ground direct fire, aircraft, and air defense weapon systems has provided unparalleled opportunities for realistic, two-sided, tactical training worldwide. We have included money in FY87 to provide the National Guard with additional sets of MILES.

Also included in this budget are efforts to achieve long-term economies and to improve the maintenance of proficiency through the use of microprocessors and lasers to provide precision simulation in lieu of live fire. The Army has a continuing need to expand the technology base for training devices and simulation to support the development of training environments and training systems that provide the training required to win in any conflict.

FY87 RDT&E PROGRAMS

PROGRAM ELEMENT NUMBER	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
	TECHNOLOGY BASE				
61101A	IN-HOUSE LAB INDEPENDENT RESEARCH	24.322	25.105	19.020	20.277
61102A	DEFENSE RESEARCH SCIENCES	208.349	233.544	212.594	219.548
61103A	UNIVERSITY RESEARCH INITIATIVES		6.052	12.380	24.606
62105A	MATERIALS	12.715	12.481	16.346	18.920
62111A	ATMOSPHERIC INVESTIGATIONS	5.575	5.498	11.563	13.686
62120A	NUCLEAR WEAPONS EFFECTS/FLUIDICS	12.476	22.488	47.797	54.152
62122A	SURVIVABILITY ENHANCEMENT				
62201A	AIRCRAFT WEAPONS TECHNOLOGY	3.594	3.307	1.416	1.724
62202A	AIRCRAFT AVIONICS TECHNOLGY	7.998	9.083	11.102	12.083
62209A	AERONAUTICAL TECHNOLGY	23.713	27.451	34.814	43.629
62210A	AIRDROP TECHNOLGY	1.749	2.053	2.900	3.094
62303A	MISSLE TECHNOLGY	35.027	28.649	24.587	30.530
62307A	LASER WEAPON TECHNOLOGY	22.007	11.133	11.228	14.195
62601A	TANK AND AUTOMOTIVE TECHNOLOGY	24.547	22.128	25.711	29.452
62603A	LARGE CALIBER AND NUCLEAR TECHNOLOGY	37.127	22.442		
62617A	SMALL CAL AND FIRE CONTROL TECHNOLOGY	9.691	11.561		
62618A	BALLISTICS TECHNOLOGY	49.862	43.413	46.155	48.288
62622A	CHEMICAL AND SMOKE MUNITIONS	15.909	14.083	23.228	26.242
62623A	JOINT SERVICE SMALL ARMS PROGRAM	6.537	5.493	11.119	11.163
62624A	WEAPONS AND MUNITIONS TECHNOLOGY			28.663	27.235
62701A	TACTICAL TELEPROCESSING TECHNOLOGY	15.020	17.213	26.894	29.260
62703A	COMBAT SURVEILL TARGET ACQUIS &IDENT	6.759	4.516	7.766	8.021
62704A	MIL ENVIRONMENTAL CRITERIA DEV	2.900	3.067	3.413	3.932
62705A	ELECTRONICS AND ELECTRONIC DEVICES	20.056	21.558	24.039	26.414
62706A	CHEM BIOLOGICAL DEF/GEN INVEST	36.852	39.568	39.656	44.310
62707A	MAPPING - GOEDESY	7.994	9.000	9.678	10.815
62709A	NIGHT VISION INVESTIGATIONS	18.007	20.840	28.056	29.890
62715A	TACTICAL ELECTRONIC WARFARE TECHNOLOGY	10.290			
62716A	HUMAN FACTORS ENG SYS DEV	10.987	13.993	17.811	20.127
62717A	HUMAN PERFORMANCE EFFECT/SIMULATION	5.156	5.228	13.113	14.760
62719A	MOBILITY AND WEAPONS EFFECTS TECHNOLOGY	9.217	12.265	14.879	15.929
62720A	ENVIRONMENTAL QUALITY HEALTH	11.043	8.930	8.760	9.213
62722A	MANPOWER/PERSONNEL/TRAINING	6.732	7.533	4.730	4.703
62723A	CLOTHING EQUIP AND SHELTER TECHNOLOGY	7.932	8.996	18.012	17.059
62724A	JT SVC FOOD SYS TECH	5.943	5.960	5.162	5.915
62725A	COMPUTER AND INFORMATION SCIENCE	2.207	2.198	2.574	2.581
62727A	NON-SYSTEM TRAINING DEVICES	5.180	5.042	4.397	6.874
62730A	COLD REGIONS ENGINEERING TECHNOLOGY	7.423	6.990	4.308	5.025
62731A	MILITARY FACILITIES ENGINEERING TECH	5.347	5.345	5.764	6.208
62733A	MOBILITY EQUIPMENT TECHNOLOGY	13.365	13.708	15.914	17.848
62734A	MED DEFENSE AGAINST CHEM AGENTS	33.265	31.101	34.613	39.889
62746A	TACTICAL SOFTWARE TECHNOLOGY		6.433	10.794	15.331
62770A	MILITARY DISEASE HAZARDS TECH	23.949	27.372	48.677	51.489

PROGRAM ELEMENT NUMBER	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
62772A	COMBAT CASUALTY CARE TECH	9.610	8.913	10.376	10.439
62775A	COMBAT MAXILLOFACIAL INJURY	3.610	2.166	2.813	3.714
62777A	SYSTEMS HEALTH HAZARD PREVENT TECH	22.114	19.428	22.223	23.130
62781A	ENERGY TECH APPL FOR MILITARY FAC TECH	2.128	2.259	2.035	2.295
	TECHNOLOGY BASE TOTAL	804.274	831.197	945.917	1045.085
	ADVANCED TECHNOLOGY DEVELOPMENT				
63102A	MATERIELS AND STRUCTURES	8.214	14.289	20.154	17.772
63104A	FUELS AND LUBRICANTS	4.479	3.358	3.527	4.186
63105A	ACQUIRED IMMUNE DEFICIENCY RESEARCH		39.516		
63201A	AIRCRAFT POWER PLANTS AND PROPULSION	20.240	19.602	20.365	26.145
63206A	AIRCRAFT WEAPONS	11.857	6.877	10.349	10.257
63207A	AIRCRAFT AVIONICS EQUIPMENT	20.250	10.838	4.408	8.754
63209A	AIR MOBILITY SUPPORT	7.782			
63211A	ROTARY WING CONTROLS/ROTORS/STRUCTURES	19.981	16.979	23.560	27.065
63216A	SYNTHETIC FLIGHT SIMULATOR DEVELOPMENT	9.189	12.462	11.162	11.581
63218A	AIRDROP ADVANCEMENT	3.575	3.819	4.547	3.628
63221A	NOE AVIATION AND NAVIGATION EQUIP	2.900	3.052	2.370	5.019
63255A	OPERATIONAL ENHANCEMENTS			2.637	4.370
63306A	TERMINALLY GUIDED PROJECTILES	7.484	14.394	27.939	50.690
63313A	MSL/ROCKET COMPONENTS	25.483	18.685	37.881	33.647
63322A	BATTLEFIELD ENVIRONMENT SIMULATION		988	7.083	8.508
63324A	ARMY DEVELOPMENT AND EQUIP ACTIVITY	38.900	9.588	11.411	15.393
63602A	ADVANCED LAND MOB SYSTEMS CONCEPTS	13.152	16.286	10.890	19.886
63606A	LANDMINE WARFARE/BARRIER DEV	13.222	11.184	11.344	13.353
63607A	JOINT SERVICE SMALL ARMS PROGRAM	6.874	3.474	9.480	7.029
63621A	COMBAT VEHICLE PROPULSION SYS	15.244	11.864	9.766	13.791
63631A	CMBT VEH TERRET AND CHASSIS SUBSYS	20.921	16.912	18.895	22.997
63636A	COMBAT VEHICLE ARMOR/ANTI-ARMOR	52.837	11.241	9.411	11.229
63637A	ADV PROPULSION/LAUNCH SYS FOR MUN	7.902	8.134	5.887	9.831
63638A	NUCLEAR VULNERABILITY ADV TECHNOLOGY			6.614	6.451
63640A	AMMUNITION LOGISTICS		1.482	2.170	5.415
63710A	NIGHT VISION ADVANCED DEVELOPMENT	30.511	31.495	29.080	36.813
63719A	SPECIAL PURPOSE DETECTORS			2.961	3.939
63723A	TACTICAL C4 TECHNOLOGY INTEGRATION		24.357	13.335	14.567
63725A	REMOTELY PILOTED VEHICLES/DRONES	13.408			
63727A	SPACE TECHNOLOGY INTEGRATION			987	985
63731A	MANPOWER AND PERSONNEL	11.349	13.882	14.204	16.323
63734A	ENGINEERING SYSTEMS	1.271	1.927	5.393	6.450
63736A	HUMAN FACTORS ENGINEERING APPLICATIONS			2.458	2.974
63737A	ANTI-RADIATION MSL COUNTER MEASURES	4.441	4.890		
63739A	HUMAN FACTORS IN TNG/OPER EFFECT	9.684	8.974	9.191	10.377
63742A	ADV ELECTRONIC DEVICES DEV	8.748	9.635	5.537	5.141
63743A	EDUCATION AND TRAINING	10.075	11.787	7.033	9.028
63744A	TRAINING AND SIMULATION	7.600	5.459	6.618	7.667
63748A	TEST MEASUREMENT AND DIAGNOSTIC EQUIP DEV	4.918	5.159	7.174	8.902
63749A	TECHNICAL VULNERABILITY REDUCTION	9.103	4.299	3.300	3.718
63752A	DEMILITARIZATION CONCEPTS	8.312	9.463		

PROGRAM ELEMENT NUMBER	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
63756A	DOD SOFTWARE INITIATIVES (STARS)	12.552	41.492		
63758A	ARMY BATTLEFIELD TECHNOLOGY INTEGRATION		11.856	12.385	12.715
63759A	CB DEF/SMK ADV TECHNOLOGY DEMONSTRATIONS	5.177	3.009	7.484	3.564
63761A	ELEC WRFR VULN/SUSCEP TECH SUPPORT	15.845	14.612		
63762A	EW FEASIBILITY DEVELOPMENT	9.652	7.157		
63763A	NONSYSTEMS MEDICAL MATERIAL DEVELOPMENT	14.644	16.026	19.492	23.077
63764A	MEDICAL CHEMICAL DEFENSE LIFE SUPPORT	33.897	22.353	17.390	17.040
63771A	ADVANCED TACTICAL COMMUNICATIONS TECH			1.461	1.502
63772A	ADV TACTICAL COMPUTER SCIENCE & TECH			13.674	12.288
63773A	BATTLEFIELD SUSTAINMENT			3.342	4.906
	ADVANCED TECHNOLOGY DEVELOPMENT TOTAL	521.673	502.856	488.034	570.433
	STRATEGIC PROGRAMS				
12814A	SPECIAL PROGRAMS				
12821A	CLASSIFIED PROGRAMS				
33152A	WORLDWIDE MILITARY CMD/CNT INF SYS	27.074	30.540	29.557	74.714
	STRATEGIC PROGRAMS TOTAL	220.502	226.877	278.987	318.447
	TACTICAL PROGRAMS				
63209A	AIR MOBILITY SUPPORT		8.281	10.848	5.528
63215A	JOINT SURVIVABILITY INVESTIGATIONS	985	890	735	1.045
63217A	GREATER SLOPE	33.998			
63220A	ADV ROTORCRAFT TECH INTEGRATION/LHX	51.575	44.311	44.420	
63225A	AIRDROP EQUIPMENT SYSTEMS		988	1.256	1.929
63302A	ANTI-TACTICAL MISSLE SYSTEM	29.275	61.315	38.635	4.830
63303A	SURF-TO-SURF MSL ROCKET SYS	24.509	30.253	42.681	52.185
63323A	LIGHT WEIGHT AIR DEFENSE SYSTEM			21.717	38.016
63604A	NUCLEAR MUNITIONS AND RADIACS	5.226	7.833		
63608A	WEAPONS AND AMMUNITION		789	173	
63612A	ADV ANTI-TANK WEAPON SYSTEM (MEDIUM)	6.003	60.338	48.735	141.820
63615A	LETHAL CHEMICAL MUNITIONS CONCEPTS	14.975	20.141	25.307	15.660
63619A	LANDMINE/BARRIER SYSTEM	15.683	22.777	10.477	8.828
63627A	SMOKE MUNITIONS AND MATERIEL CONCEPTS	3.409	8.497	3.189	7.709
63628A	ARTILLERY/MORTAR AMMO DEVELOPMENT	9.169	10.151	17.210	12.841
63633A	TANK/FIGHTING VEHICLE AMMO DEVELOPMENT	10.408	5.665		
63635A	MOBILE PROTECTED GUN				16.824
63639A	ARMAMENT ENHANCEMENT INITIATIVE (AEI)				
63641A	PROGRAM 292				
63702A	ELECTRIC POWER SOURCES	5.537	11.154	8.017	15.109
63705A	PHYSICAL SECURITY	1.800	4.397	2.339	3.274
63706A	IDENT FRIEND OR FOE DEVELOPMENT	13.670	18.479	20.373	5.678
63707A	COMMUNICATIONS DEVELOPMENT	4.965	2,905	2.673	3.652
63711A	AIRCRAFT SURVIVABILITY EQUIPMENT	3.090	8.128	4.588	18.170
63713A	ARMY DATA DISTRIBUTION SYSTEM	23.949	37.266	42.122	22.605
63718A	ELECT WRFR VULNERABILITY/SUCEPTIBILITY	26.465	22.633	16.912	22.124
63720A	CHEM/BIO DETECTION WARN/SAMP MAT CONCEPTS	35.235	15.008		16.019
63721A	CHEM/BIO PROTECTIVE MATERIEL CONCEPTS	3.759	9.378	8.045	4.058

PROGRAM ELEMENT NUMBER	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
63723A	MISSION CRITICAL SOFTWARE	16.601			
63725A	REMOTELY PILOTED VEHICLES/DRONES		259	4.917	19.973
63726A	COMBAT SUPPORT EQUIPMENT	15.011	25.148	24.285	14.180
63730A	TACTICAL SURVEILLANCE SYSTEM		21.411		
63732A	COMBAT MEDICAL MATERIAL	6.336	9.271	8.189	11.396
63740A	SHORT RANGE AIR DEF COMMAND AND CONTROL		10.000	16.189	15.265
63741A	METEOROLOGIC EQUIPMENT DEVELOPMENT				2.192
63745A	TACTICAL ELECTRONIC SPT MEASURE SYS	5.083	4.807		
63746A	SINGLE CHAN GND & ABN RADIO SYS AD	3.519	2.240		
63747A	SOLDIER SUPPORT/SURVIVABILITY	3.428	4.992	4.722	6.196
63750A	DRUG AND VACCINE DEVELOPMENT	14.721	16.745	17.077	16.474
63751A	MEDICAL DEFENSE AGAINST CHEM WARFARE	21.820	30.652	26.449	29.502
63754A	CLASSIFIED PROGRAM (ADV)				
63755A	TACTICAL ELECTRONIC COUNTERMEASURES SYS	44.957	78.091		
63757A	AIR DEFENSE ALTERNATIVES		30.504	103.944	188.995
63766A	TACTICAL ELECTRONIC SURVEILLANCE SYS	9.239	6.735		
63767A	COMBAT SERVICE SUPPORT CONTROL SYS	190	969	4.608	5.318
63774A	NIGHT VISION SYSTEMS ADVANCED DEVELOPMENT			3.307	10.045
64202A	AIRCRAFT WEAPONS	6.349	12.527		
64204A	AIR MOBILITY SUPPORT EQUIPMENT	5.126	2.583	4.418	4.832
64206A	UH-60 BLACKHAWK		16.759		
64207A	ADVANCED ATTACK HELICOPTER	27.682	9.921	12.931	6.083
64216A	AIRCRAFT PROPULSION SYSTEMS	19.975	69.934	111.301	149.672
64217A	SYNTHETIC FLIGHT TRAINING SYSTEMS	17.242	7.673	10.680	9.843
64218A	AIRDROP EQUIPMENT DEVELOPMENT	4.036	3.113	3.281	3.848
64220A	ARMY HELICOPTER IMPROVEMENT PROGRAM	25.199	6.720		
64223A	ADVANCED TECH LIGHT HELO SERIES				194.445
64268A	AIRCRAFT ENGINE COMPONENT IMPROVEMENT	11.046	15.963		
64306A	STINGER	5.000	23.298	6.252	
64307A	PATRIOT AIR DEFENSE MISSLE SYS	61.072	50.832		
64310A	HELIBORNE MISSLE-HELLFIRE	454	4.945		
64313A	GRASS BLADE	15.646	10.747	6.698	13.278
64314A	MULTIPLE LAUNCH ROCKET SYSTEM	1.851			
64321A	JOINT TACTICAL FUSION PROGRAM	76.880	155.209		
64324A	JOINT TACTICAL MISSLE SYSTEM-ARMY	76.378	128.426	88.197	97.719
64601A	INFANTRY SUPPORT WEAPONS	27.202	29.113	26.044	5.773
64603A	NUCLEAR MUNITIONS	11.985	18.074		
64604A	MOBILITY		988	47.828	38.265
64608A	INFANTRY WEAPONS AND AMMUNITION				2.237
64609A	SMOKE MUNITIONS AND MATERIEL	4.016	5.879	7.892	15.162
64610A	LETHAL CHEMICAL MUNITIONS				20.879
64612A	COUNTERMINES AND BARRIERS	2.607	7.929	9.728	16.037
64616A	FIGHTING VEHICLE SYSTEM	11.209			
64619A	LANDMINE WARFARE	8.176	7.818	16.755	11.813
64630A	M1A1 DEVELOPMENT PROGRAM	56.803	18.717	3.798	
64631A	FIELD ARTILLERY AMMUNITION	7.967	27.442	107.275	84.479
64632A	105MM TANK AMMUNITION	146	1.574		

PROGRAM ELEMENT NUMBER	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
64633A	CACTUS PLANT				
64701A	COMM ENGINEERING DEV	7.801	10.602	6.473	6.296
64702A	JT TACTICAL INFORMATION DIST SYS	22.764	12.105		
64704A	UNATTENDED GROUND SENSORS		494		
64705A	MODULAR INTEGRATED COMM AND NAV SYS	8.282	4.957	8.224	
64706A	RADIOLOGICAL DEFENSE EQUIPMENT	840	656		1.587
64709A	IDENTIFICATION FRIEND OR FOE EQUIP DEV	1.255		9.871	18.976
64710A	NIGHT VISION DEVICES	8.072	14.456	21.944	29.998
64711A	AIRCRAFT SURVIVABILITY EQUIPMENT	14.043	21.662	19.934	17.743
64712A	ARMY COMMAND AND CONTROL SYS ENG	11.858	9.247	6.113	11.058
64713A	COMBAT FEEDING, CLOTHING AND EQUIPMENT	6.174	3.986	4.363	5.423
64714A	TACTICAL ELECTRICAL POWER SOURCES	9.520	10.043	6.449	3.675
64717A	GENERAL COMBAT SUPPORT	17.644	14.225	11.538	23.905
64718A	PHYSICAL SECURITY	6.141	6.450	1.216	4.384
64722A	EDUCATION AND TRAINING	6.899	6.531	4.378	7.273
64723A	SPECIAL PURPOSE DETECTORS	3.315	3.217	1.181	961
64724A	CML/BIO DETECTION WARNING & TRAINING MAT	1.801	22.845	31.427	21.038
64725A	CHEM BIO PROTECTIVE MATERIEL	17.932	15.524	10.550	27.631
64727A	COMMAND AND CONTROL	16.166	5.757	548	550
64730A	REMOTELY PILOTED VEHICLES	97.783	73.868	91.880	19.376
64735A	INFRARED TERMINALLY GUIDED SUBMUNITION			27.114	29.546
64740A	TACTICAL SURVEILLANCE SYSTEM	16.494	17.703		
64741A	DIVISION AIR DEFENSE COMMAND AND CONTROL	18.399	32.640	82.065	116.214
64746A	AUTOMATIC TEST EQUIPMENT DEVELOPMENT	7.923	17.915	12.325	13.589
64750A	TACTICAL ELECTRONIC COUNTERMEASURES SYS	10.487	34.706		
64751A	SINGLE CHAN GND & ABN RADIO SYS ED	7.013	12.735	13.922	6.709
64754A	CLASSIFIED PROGRAM (ENG)				
64757A	MEDICAL CHEMICAL DEFENSE LIFE SPT MAT	3.485	7.587	9.204	11.756
64758A	DRUG AND VACCINE DEVELOPMENT	8.988	10.371	10.563	10.845
64766A	TACTICAL ELECTRONIC SURVEILLANCE SYS	18.121	11.134		
64770A	JOINT SURVEILLANCE/TARGET ATTACK RADAR	50.000	43.288	27.882	6.197
64779A	JT INTEROP OF TAC CMD & CONT SYS	37.238	6.337	7.719	8.485
65710A	JT CB POINT OF CONTACT, TEST & ASSESM'T	2.345	2.373	6.249	6.541
23724A	HV ANTI-TANK ASSAULT WPN SYS (TOW)	11.873	11.693	12.468	18.938
23726A	ADV FIELD ARTILLERY TACTICAL DATA SYS	29.242	19.765	40.444	67.205
23727A	MED ANTI-TANK ASSAULT WEAPON - DRAGON		2.470		
23730A	CHAPARRAL	17.911	17.452	5.627	
23731A	SAM HAWK/HAWK IMP PROG	21.497	5.149	10.633	15.902
23735A	COMBAT VEHICLE IMPROVEMENT PROGRAM	120.110	72.234	79.203	67.855
23739A	AN/TSQ-73 MODIFICATIONS			9.671	13.887
23740A	MANEUVER CONTROL SYSTEM	21.869	8.565	9.401	14.901
23741A	PROD IMPR VULCAN AIR DEF SYS	142			
23743A	155MM	27.712	25.474	35.726	50.164
23744A	AIRCRAFT MODIFICATIONS	6.200			
23745A	EQUIPMENT UPGRADE	5.318	25.036	23.343	6.462
23746A	PATRIOT PRODUCT IMPROVEMENT PROGRAM			40.221	50.248
23747A	HELLFIRE PRODUCT IMPROVEMENT PROGRAM			11.947	25.301

PROGRAM ELEMENT NUMBER	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
23749A	MLRS PRODUCT IMPROVEMENT PROGRAM				650
23751A	SPECIAL OPERATIONS FORCES EQUIPMENT			31.242	59.644
23752A	AIRCRAFT ENGINE COMPONENT IMPROVEMENT			14.592	15.977
28010A	JOINT TACTICAL COMMO PROGRAM (TRITAC)	40.324	30.233	17.401	20.189
33145A	EUCOM C3 SYSTEMS	5.501	1.938	1.078	1.316
	TACTICAL PROGRAMS TOTAL	1,726.341	2,083.622	2,440.170	2,940.527
	INTELLIGENCE AND COMMUNICATIONS				
63712A	MAPING AND GEODESY	3.532	3.186		
64201A	AIRCRAFT AVIONICS	1.246	2.212	2.493	2.482
64716A	MAPPING AND GEODESY	3.863	2.227	11.473	9.122
64778A	NAVSTAR GLOBAL POS SYS (USER EQ)	13.631	11.146	4.719	6.700
31307A	FOREIGN SCIENCE AND TECH CENTER				
31318A	HUMINT (CONTROLLED)				
31327A	TECHNICAL RECONNAISSANCE AND SURVEILLANCE				
31329A	EUCOM CSIC DESIGN				
31359A	SPECIAL ARMY PROGRAMS				
33111A	STRATEGIC ARMY COMMUNICATIONS (STARCOM)	1.062			
33126A	LONG-HAUL COMMUNICATIONS (DCS)	5.542	4.260	2.684	2.531
33142A	SATCOM GROUND ENVIRONMENT	15.076	58.932	94.478	104.673
33401A	COMMUNICATIONS SECURITY (COMSEC)	11.398	8.993	7.280	9.187
	INTELLIGENCE AND COMMUNICATIONS TOTAL	61.086	97.770	130.420	141.690
	DEFENSEWIDE MISSION SUPPORT				
63315A	TARGET MISSLES	1.496	3.952	9.731	12.924
63738A	NONSYSTEMS TRAINING DEVICES (NSTD) DEV	500	4.842	3.869	4.826
63790A	NATO RESEARCH AND DEVELOPMENT		24.698	49.356	
64715A	NONSYSTEMS TRAINING DEVICES ENGR	32.922	47.122	46.260	32.062
64726A	METEOROLOGICAL EQUIPMENT AND SYSTEMS	12.319	4.967	1.207	1.367
65201A	AVIATION ENGINEERING FLIGHT ACTIVITY	10.100	9.708	13.217	13.669
65301A	KWAJALEIN MISSLE RANGE	166.265	152.300	163.470	175.793
65502A	SML BUSINESS INNOVATIVE RESEARCH	16.323			
65702A	SUPPORT OF DEVELOPMENTAL TESTING	48.493	56.404	50.444	59.969
65706A	MATERIEL SYSTEMS ANALYSIS	15.746	16.043	16.966	17.932
65709A	EXPLOITATION OF FOREIGN ITEMS	3.443	3.535	3.984	4.468
65712A	SUPPORT OF OPERATIONAL TESTING	54.295	51.937	55.745	64.739
65716A	THREAT SIMULATORS FOR TESTING		32.601	34.279	33.906
65717A	NUCLEAR SURVIVABILITY TESTING & ANALYSIS			3.950	5.553
65801A	PROGRAM WIDE ACTIVITIES	92.133	171.766	85.484	93.979
65802A	INTL COOPERATIVE RESEARCH AND DEV	611	936	977	1.284
65803A	TECHNICAL INFO ACTIVITIES	5.750	6.196	6.772	7.875
65804A	AMC MAJOR RANGES AND TEST FACILITIES	324.825	357.120	207.799	230.412
65805A	MUN STANDARDIZAT'N EFFECTIVENESS & SAFTEY	7.145	11.367	11.610	11.609

PROGRAM ELEMENT NUMBER	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
65806A	DOD HIGH ENERGY LASER SYSTEMS TEST FAC	32.811	19.940	20.729	21.471
65810A	RDTE SUPPORT FOR NON-DEVELOPMENTAL ITEMS			9.194	13.170
65872A	PRODUCTIVITY INVESTMENTS	11.855	20.747	53.893	15.548
65894A	REAL PROPERTY MAINTENANCE (RDT&E)			174.536	214.054
65896A	BASE OPERATIONS (RDT&E)			202.951	211.115
65898A	MGT HQ (RESEARCH/DEVELOPMENT)	41.921	12.018	11.244	11.582
78011A	INDUSTRIAL PREPAREDNESS	92.356	90.951	29.105	30.145
	DEFENSEWIDE MISSION SUPPORT TOTAL	971.309	1,099.150	1,266.772	1,289.452
TOTAL RESEARCH DEVELOPMENT TEST & EVAL, ARMY		4,305.185	4,841.472	5,550.300	6,305.634

FY87 AIRCRAFT PROCUREMENT, ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
	FIXED WING				
A02700	C-12 CARGO AIRPLANE	24.0	12.0		
A02000	GUARDRAIL/COMMON SENSOR ROLL				3.3
A02005	RC-12D RECON AIRPLANE	89.3			72.1
	FIXED WING TOTAL	113.3	12.0	0.0	75.4
	ROTARY				
A03400	CH-47 CARGO HELICOPTER (CHINOOK)	110.0			
A04300	EH-60A HELICOPTER (QUICKFIX)	97.6	104.6	135.0	
A04300	EH-60A HELICOPTER (QUICKFIX) ADV PROC	30.4	24.4	16.9	
A06605	AH-64 ATTACK HELICOPTER (APACHE)	1159.2	1087.8	1189.3	
A06605	AH-64 ATTACK HELICOPTER (APACHE) ADV PROC	87.6	55.3	39.1	
A05002	UH-60A BLACK HAWK (MYP)	271.0	210.9	155.4	336.6
A05002	UH-60A BLACK HAWK (MYP) ADV PROC	171.8	199.0	195.0	191.4
	ROTARY TOTAL	1927.6	1682.0	1730.7	1419.1
	MODIFICATIONS				
AZ3530	OV-1 MOHAWK SURVEILLANCE AIRPLANE	24.9	22.7	24.9	39.3
AZ2000	RC12-D RECON AIRPLANE	6.2			
AZ2100	RV-1 RECON AIRPLANE	4.7		2.7	5.4
AA0150	AH1S ATTACK HELICOPTER (COBRA-TOW)	70.3	128.9	61.0	81.0
AA6605	AH-64 MODS			33.4	33.0
AA0250	CH-47 CARGO HELICOPTER (MYP)	231.5	219.0	208.4	173.9
AA0250	CH-47 CARGO HELICOPTER (MYP) ADV PROC	159.9	124.8	58.6	69.2
AA0300	CH-54 CARGO HELICOPTER (TARHE)		.5	1.3	10.3
AZ1200	EH-1 ELECTRONIC HELICOPTER (Q-FIX MOD)	3.7			
AA0400	OH-58 OBSERVATION HELICOPTER (KIOWA)	48.8			
AA0600	UH-1 UTILITY HELICOPTER (IROQUOIS)	6.5	11.7	6.3	18.8
AA0490	UH-60 BLACKHAWK MODS	15.8	13.6	7.7	18.8
AZ2200	ARMY HELO IMPROVEMENT PROGRAM (AHIP)	161.0	166.6	164.9	113.2
AZ2200	ARMY HELO IMPROVEMENT PROGRAM ADV PROC	47.2	20.9	45.4	129.1
AZ3900	AIR TO AIR STINGER ACFT MOD			28.8	41.5
AA0700	AIRBORNE AVIONICS	9.5	1.0	.1	1.9
AA0720	ASE MODIFICATIONS CLOSE COMBAT			3.5	.1
AA0725	MODIFICATIONS UNDER $2.0M (AIRCRAFT)	1.1	.1	.1	2.6
AZ3405	ACFT WW	66.9	16.3	12.0	24.4
Z3407	SOF AIRCRAFT MODIFICATIONS			3.5	67.0
	MODIFICATIONS TOTAL	857.9	726.1	662.6	829.5
	SPARES AND REPAIR PARTS				
AA0950	SPARE PARTS	677.7	814.3	710.5	786.9
	SPARE PARTS TOTAL	677.7	814.3	710.5	786.9
	GROUND SUPPORT AVIONICS				
AZ3504	AIRCRAFT SURVIVABILITY EQUIPMENT			11.6	88.5
	GROUND SUPPORT AVIONICS TOTAL	0.0	0.0	11.6	88.5

FY87 AIRCRAFT PROCUREMENT, ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
	OTHER SUPPORT				
AZ3000	AVIONICS SUPPORT EQUIPMENT	53.7	65.0	57.9	80.4
BA9999	HELIBORNE C2 CONSOLE				2.3
AZ3020	MLS AVIONICS				7.6
AZ3100	COMMON GROUND EQUIPMENT	15.6	33.5	28.4	29.7
AA0050	AIR TRAFFIC CONTROL	8.9	9.0	4.8	2.9
AZ3800	SYNTHETIC FLIGHT TRAINING SYSTEMS	156.3	117.1	37.7	61.5
AZ3300	INDUSTRIAL FACILITIES	39.2	59.3	16.0	22.8
A50100	WAR CONSUMABLES	3.6	5.9	4.5	4.2
	OTHER SUPPORT TOTAL	277.4	289.8	149.3	211.4
	ARMY AIRCRAFT APPROPRIATION TOTAL	3853.8	3524.2	3264.7	3410.8

FY87 MISSLE PROCUREMENT, ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
	SURFACE-TO-AIR MISSLE SYSTEM				
C22100	CHAPARRAL	31.0	54.9	103.7	114.5
CC2100	NON LINE OF SIGHT AIR DEFENSE SYSTEM				14.2
CC2200	AIR DEFENSE SYS HEAVY			9.1	65.4
CC2300	AIR DEFENSE DIV SYSTEM LIGHT				
CA0275	OTHER MISSLE SUPPORT	8.3	5.0	6.5	4.7
C49100	PATRIOT (MYP)	958.8	928.1	951.5	912.7
C49100	PATRIOT (MYP) ADV PROC			45.3	40.1
C18500	STINGER (MYP)	207.3	246.6	251.7	337.7
C18500	STINGER (MYP) ADV PROC			40.3	45.5
	SURFACE-TO-AIR SYSTEM TOTAL	1205.4	1234.6	1408.1	1609.5
	AIR-TO-AIR MISSLE SYSTEM				
C70000	LASER HELLFIRE SYSTEM	224.0	223.2		190.6
	AIR-TO-SURFACE MISSLE SYSTEM TOTAL	224.0	223.2	0.0	190.6
	ANTI-TANK/ASSAULT MISSILE SYSTEM				
C59300	TOW 2	184.0	160.9	134.6	176.3
C59300	TOW 2 ADV PROC	16.2	22.0	15.5	
C76500	PERSHING	370.0	224.5	31.8	
C67600	MULTIPLE LAUNCH ROCKET SYSTEM (MYP)	371.6	468.9	474.2	480.2
C67600	MULTIPLE LAUNCH ROCKET SYSTEM ADV PROC	137.4	41.0		
	ANTI-TANK/ASSAULT MISSLE SYSTEM TOTAL	1079.2	917.3	656.1	663.5
	MODIFICATIONS				
C50700	PATRIOT	11.8	16.5	38.6	52.8
C24200	CHAPARRAL	93.8	106.7	5.2	13.5
C35200	HAWK	55.6	46.9	68.2	50.5
C61700	TOW	31.0	16.9	53.0	38.9
C57300	DRAGON			4.7	
C76200	LANCE MODIFICATIONS			3.8	16.1
C97500	LCSS	3.8			
C92800	PERSHING MODIFICATIONS	3.0			10.1
C54000	AN/TSQ-73	11.4			
	MODIFICATIONS TOTAL	210.4	187.0	173.5	181.9
	SPARES AND REPAIR PARTS				
CA0250	SPARES AND REPAIR PARTS	244.8	286.8	150.9	301.3
	SPARES AND REPAIR PARTS TOTAL	244.8	286.8	150.9	301.3
	SUPPORT EQUIPMENT AND FACILITIES				
C93000	AIR DEFENSE TARGETS	30.4	19.8	32.4	31.6
CL2000	ITEMS LESS THAN $2.0M (MISSILES)	6.6	3.7	1.5	2.2
CA0100	PRODUCTION BASE SUPPORT	56.5	29.9	15.7	17.7
CA4600	OTHER PRODUCTION CHARGES	38.6	2.0		
	SUPPORT EQUIPMENT AND FACILITIES TOTAL	132.1	55.4	49.6	51.5
ARMY MISSLE PROCUREMENT APPROPRIATION TOTAL		3095.9	2904.3	2438.2	2998.3

PROCUREMENT WEAPONS AND TRACKED COMBAT VEHICLES, ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
	TRACKED COMBAT VEHICLES				
G80300	CARRIER, COMMAND POST LIGHT, FT, M577A2	33.4	30.6	64.1	
G80711	CARRIER, PERSONNEL, FT, ARM, M113A3	8.9	117.7		80.8
G80702	BRADLEY FIGHTING VEHICLES (MYP)	844.8	905.9	1121.8	1163.6
G80702	BRADLEY FIGHTING VEHICLES (MYP) ADV PROC	24.9	27.6	20.6	13.2
G20900	BRADLEY (BFVS) TRAINING DEVICES	56.5	73.2	9.5	
GZ2500	BRADLEY (BFVS) TRAINING DEVICES (MOD)				6.2
G80100	FIELD ARTILLERY AMMUNITION SUPPORT VEH	81.2	64.8	67.5	77.4
G24600	HOWITZER, MED SP, FT, 155MM, M109A2	51.8			
G82500	RECOVERY VEHICLE, MED, FT, M88A1	148.3	199.4	42.8	121.1
G82916	ABRAMS TANK SERIES ROLL (MYP)	1524.7	1505.0	1643.6	1738.8
G82916	ABRAMS TANK SERIES ROLL (MYP) ADV PROC	308.3	348.2	351.4	356.0
GC2600	M60 SERIES TANK TRAINING DEVICES	13.9	16.8	33.5	32.4
GB1300	M1 SERIES TANK TRAINING DEVICES	37.3	61.0	9.5	.9
	TRACKED COMBAT VEHICLES TOTAL	3134.0	3350.2	3364.3	3590.4
	MODIFICATION OF TRACKED COMBAT VEHICLES				
GB1930	CARRIER, MOD	44.7	54.7	48.4	61.5
GZ2000	IMPROVED TOW VEHICLE (ITV) (MOD)	32.6			
GZ2300	FIST VEHICLE (MOD)	72.8	71.9	53.8	18.2
GZ2400	BFVS SERIES (MOD)	3.9	12.0	35.1	56.7
GA0400	HOWITZER, MED SP FT 155MM M109 (MOD)	28.8	6.0	20.8	64.5
GZ3000	ARMORED VEH LAUNCH BRIDGE (AVLB) (MOD)	13.4	15.6		
GA0650	TANK, COMBAT, FT, 105MM GUN, M60SER (MOD)	212.2	105.2	48.3	77.6
GA0700	TANK, M1 SERIES (MOD)	9.2	53.9	80.4	175.7
GZ3405	9WW				2.8
GA9002	MOBILE TRAINING BASE EQUIP			17.0	17.6
GA9003	HOST NATION SUPPORT			4.7	
	MOD OF TRACKED COMBAT VEHICLES TOTAL	417.6	319.3	308.5	474.6
	SUPPORT EQUIPMENT AND FACILITIES				
GA0150	SPARES AND REPAIR PARTS (TCV-WTCV)	426.1	600.6	469.8	542.1
GA0175	VALUE ENGINEERING	1.0			
GL3100	ITEMS LESS THAN $2.0M (TCV-WTCV)	1.7	.8	2.0	2.0
GA0050	PRODUCTION BASE SUPPORT (TCV-WTCV)	75.3	78.9	57.8	41.8
	SUPPORT EQUIPMENT AND FACILITIES TOTAL	504.1	680.3	529.6	585.9
	WEAPONS AND OTHER COMBAT VEHICLES				
GZ6000	FOLLOW-ON AIR DEFENSE GUN		150.0		
G01300	HOWITZER, LIGHT, TOWED, 105MM, L119			26.5	32.0
G01402	HOWITZER, MED, TOWED, 155MM, M198				11.9
G11101	MACHINE GUN, 7.62MM, M60			5.0	5.4
G13000	ARMOR MACHINE GUN, 7.62MM M240	23.4		24.2	25.0
G10100	MOUNT MACH GUN CAL 50 M3				2.2
G12901	SQUAD AUTOMATIC WEAPON (SAW) 5.56MM			12.9	16.5
G13400	GRENADE LAUNCHER, AUTO, 40MM, MK 19-3	5.4			
G71100	LAUNCHER, SMOKE GRENADE	4.8	2.1	1.8	2.0

PROCUREMENT WEAPONS AND TRACKED COMBAT VEHICLES, ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
G02202	MORTAR, 81MM, M252	11.3	5.7	10.1	10.5
G03000	MORTAR, 120MM		5.0	13.2	22.4
G14900	M16 RIFLE	36.6	35.0	36.8	38.8
G15300	PERSONAL DEFENSE WEAPON, 9MM	9.1	7.5	4.4	5.1
G21100	VEH RAPID FIRE WPN SYS-BUSHMASTER (MYP)	39.1	31.9	37.3	38.0
G21100	VEH RAPID FIRE-BUSHMASTER ADV PROC	3.0	8.3	3.2	2.2
G21400	TANK MUZZLE BORESIGHT DEVICE	3.2	4.0		
	WEAPONS AND OTHER COMBAT VEHICLES TOTAL	135.9	249.5	175.4	212.0
	MODIFICATION OF WEAPONS AND OTHER COMBAT VEHICLES				
GZ2800	M16A1 RIFLE MODS		3.3	3.3	3.5
GC0925	MODIFICATIONS UNDER $2.0M (WOCV-WTCV)	.9	2.5	4.0	4.8
	MODIFICATIONS OF WEAPONS/OTHER VEHICLES	.9	5.8	7.3	8.3
	SUPPORT EQUIPMENT AND FACILITIES				
GC0150	SPARES AND REPAIR PARTS (WOCV-WTCV)	22.0	28.6	17.6	28.0
GL3200	ITEMS LESS THAN $2.0M (WOCV-WTCV)	4.3	2.9	3.3	3.4
GC0050	PRODUCTION BASE SUPORT (WOCV-WTCV)	52.2	40.2	37.0	43.5
GC2701	CANNON TUBE FORGINGS FOR SURGE			9.6	
	SUPPORT EQUIPMENT AND FACILITIES TOTAL	78.5	71.7	67.5	74.9
	ARMY WEAPONS AND TRACKED COMBAT VEH TOTAL	4271.1	4676.8	4452.6	4946.1

AMMUNITION PROCUREMENT, ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
	ATOMIC MATERIEL				
EA0050	NUCLEAR WEAPONS SUPPORT MATERIEL	11.8	3.4	2.6	2.4
E82700	PROJ, NUCLEAR, 155MM			11.7	
	ATOMIC MATERIEL TOTAL	11.8	3,4	14.3	2.4
	CONVENTIONAL AMMUNITION				
E00701	CTG, 5.56MM, BALL M193	7.7	10.1	15.0	10.9
E00702	CTG, 5.56MM, TRACER			5.6	6.8
E00703	CTG, 5.56MM, TRACER CLIP			4.8	.9
E01100	CTG, 5.56MM, BLANK M200	14.4	10.0	7.0	22.3
E01101	CTG, 5.56MM, BLK M200, LKD F/SAW	4.9	2.2	18.4	6.5
E04600	CTG, 5.56MM, 4 BALL M855/1 TRCR M856 LKD	7.9	9.6	29.4	36.3
E04601	CTG, 5.56MM, BALL M16-A2	10.1	25.0	3.4	26.5
E04602	CTG, 5.56MM, TRACER M16-A2	1.7	6.5		8.9
E02002	CTG, 7.62MM, 4 BALL M8C/1 TRCR M62 LKD	22.9	25.8	68.5	81.3
E02003	CTG, 7.62MM, BALL M80 LKD/M13		.7	2.7	4.7
E02007	CTG, 7.62MM, LKD 4 BALL ITRACER OHF		2.0	.5	2.8
E01902	CTG, 7.62MM, BLANK M82 LKD/M13			15.9	11.2
E05700	CTG, CAL .45, BALL M1911	.7	2.2	.7	1.2
E07000	CTG, CAL .50, PLASTIC LKD 4 BALL/ 1 TRCR			5.4	2.8
E06400	CTG, CAL .50, LKD 4 BALL/1 TRCR W/M15A2LK	10.9	11.3	9.6	12.0
E06800	CTG, CAL .50, APIT, M20 LKD		1.4	4.0	5.3
E07100	CTG, CAL .50, BALL LKD		3.8	2.5	4.7
E07302	CTG, CAL .50, BLK, M1A1, LKD W/M9LK F/M2	19.5			12.6
E07303	CTG, CAL .50, BLK M1A1, LKD F/M85MG (MYP)				2.9
E07700	CTG, .50 CAL, LKD TRACER M17	3.2			
E07200	CTG, CAL .50, LKD 4 BALL/1 TRCR W/M9 LK		48.0	22.9	34.8
E08904	CTG, 20MM, LKD TP-T M220 SERIES MLB M14A2	4.2	7.9	9.7	7.9
E08902	CTG, 20MM, LKD 4 TP M55A2/1TP-T M220			3.3	5.0
E08201	CTG, 25MM, HEI-T M792 W/F	40.8	24.9	48.7	57.6
E08202	CTG, 25MM, APDS-T M791 W/M28(MYP)	49.6	11.1		
E08203	CTG, 25MM, TPT LKD M793 MLB M28		41.2	25.5	18.5
E09900	CTG, 30MM, LKD HEDP M789 W/FUZE	22.9	5.0		
E10100	CTG, 30MM, LKD PT M788	7.7	9.3	2.4	2.1
E11800	CTG, 40MM, HEDP M430	17.0	43.5	28.7	49.0
E71100	CTG, 40MM, TP F/MK19		4.8	7.5	8.0
E13300	CTG, 40MM, GREEN STAR PARACHUTE				3.9
E13800	CTG, 40MM, PRAC M781	5.1	4.6	3.6	7.6
E11300	CTG, 40MM, RED SMOKE MARKER			1.8	3.9
E11400	CTG, 40MM, GREEN SMOKE MARKER			1.9	3.9
E11500	CTG, 40MM, YELLOW SMOKE MARKER			1.9	4.1
E12100	CTG, 40MM, WHITE STAR CLUSTER M585 F/LCHR				2.7
E12400	CTG, 40MM, RED STAR, PARACHUTE				3.8
E15200	CTG, 75MM, BLANK, M337A1 F/HOWITZER		2.8		
E76100	CTG, 81MM: ILLUM XM853		7.5	3.4	2.9
E18403	CTG, 81MM: HE, M821 W/FUZE M734 MO	67.8	47.7	91.3	23.5
E76200	CTG, 81MM: SMOKE, RP, XM819		6.2	11.0	11.8
E69601	CTG, 81MM: FULL RANGE, PRACTICE, XM879	7.9			
E19800	CTG, 81MM: 1/10 RNG, PRAC, XM880		2.4	2.9	2.4

AMMUNITION PROCUREMENT, ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
E25100	CTG, 4.2-IN HE M329A2 W/O FUZE	18.4	32.4	22.0	
E25501	CTG, 120MM: HE, XM933, W/FUZE M734 MO			44.7	42.6
E25503	CTG, 120MM: ILLUM, XM930			5.5	5.6
E25504	CTG, 120MM: SMOKE, XM929			14.3	14.2
E23900	CTG, 105MM, HEAT MP T M456A2	45.0	41.6	7.7	
E24000	CTG, 105MM,TP-T, M490	39.3	32.1		17.3
E67902	CTG, 105MM, TRACE-P FOR M833	5.7	2.3		
E22100	CTG, 105MM, DS-TP M724	80.8	89.4	41.6	42.2
E67901	CTG, 105MM, APFSDS-T M833	46.4	42.3	20.3	36.9
E73100	CTG, 120MM APFSDS-T M829	41.7	132.0	75.9	89.6
E73200	CTG, 120MM HEAT-MP-T, M830(MYP)	33.2	42.1	27.8	17.9
E73300	CTG, 120MM TP-TM831 (MYP)	40.4	39.6	38.8	
E73400	CTG, 120MM TPCSDS-T, M865(MYP)	62.6	65.0	104.9	123.2
E28100	PROJ, 155MM, HE, ICM M483	246.9	269.8	173.0	91.3
E67800	PROJ, 155MM, SMK, WP, M825	12.5	13.1	13.5	10.9
E67100	PROJ, 155MM, HE ADAM M692	32.0			
E67200	PROJ, 155MM, HE, ADAM M731	34.9	20.6	33.9	28.0
E67500	PROJ, 155MM, HE, RAAMS M718			11.9	8.9
E67502	PROJ, 155MM, HE RAAMS M741	100.9	75.1	105.4	37.1
E68500	PROJ, 155MM, BASEBLEED, XM864			31.6	71.7
E67600	PROJ, 155MM, HE COPPERHEAD (EA)	200.8	219.1	8.2	190.1
E28001	PROJ, 155MM, CHEM GB-2		21.7	60.6	
E27201	CHARGE, PROPELLING, M155MM GREEN BAG M3	32.4	12.2	38.0	6.1
E27301	CHARGE, PROPELLING, M155MM, WHITE BAG, M4	30.0			
E27303	CHARGE, PROPELLING, M155MM, RED BAG M203		20.4	20.0	37.6
E27100	CHARGE, PROPELLING, M155MM, RED BAG M119	120.4		55.6	46.9
E6700	PROJ, 8-INCH, HE ICM (DP), M509	129.5	50.0		
E66600	PROJ, 8-INCH, HE, RAP, M650	15.4	26.0	37.3	33.4
E29202	CHARGE, PROPELLING, 8-INCH WB, M188	64.7		4.0	
E62704	FUZE, PROXIMITY, M732				16.7
E62208	FUZE, PD M739/M739A1	3.6			
E61302	FUZE, MTSQ M577/M577A1	50.8	49.3	11.7	21.4
E61503	FUZE, MTSQ M582/M582A1	4.8	10.5	11.2	1.6
E63000	PRIMER, PERC, M82		2.9	1.8	1.4
E40601	GROUND IMP MINE SCAT SYS AP M74 (MYP)	19.5			
E40602	GROUND IMP MINE SCAT SYS AT M75 (MYP)	39.2			
E72194	CANISTER MINE (VOLCANO) PRACTICE XM88			1.9	3.0
E72195	CANISTER MINE (VOLCANO) XM87			31.6	31.2
E76900	MTR RKT 5 IN MK22 MOD4	4.0	11.4	13.3	9.3
E75100	LINE CHARGE M58A3 (MCLIC)	12.5	22.3	24.4	17.9
E71200	MODULAR MINE PACK SYSTEM	15.1		23.4	36.2
E77100	PURSUIT DETERRENT MUNITION			2.1	
E55400	DEMOLITION MUNITIONS & OTHER	18.4	16.5	13.7	17.1
E50700	DEMO KIT BANGALORE TORPEDO		3.0		
E53400	RETROFIT, CTG 105MM HE M760	2.3			
E36100	LIGHTWEIGHT MULTI-PURPOSE WEAPON	43.0	58.2	82.5	84.9
E32900	LIGHT WGT MULTI PURPOSE SYSTEM TRNR	3.4	3.1	2.5	2.4
E37327	HYDRA 70 RKT, MPSM HE M261 WHD (MYP)	33.0	28.9		

AMMUNITION PROCUREMENT, ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
E37309	HYDRA 70 RKT, HE/RS (M151/M433)				12.9
E37314	HYDRA 70 RKT, ILLUM M257 WHD				6.2
E37334	HYDRA 70 RKT, MPSM PRAC M267 WHD	5.4	5.4	2.7	16.6
E37335	HYDRA 70 RKT, HE/PD (M151/M423/MK66)		7.0	44.8	
E34000	GRENADE, HAND, ALL TYPES	17.7	28.7	27.4	24.0
E33300	GREN SMK SCREENING RP L8A1/L8A3		9.8	6.3	3.8
E32500	GRENADE, SMOKE SCREENING IR M76	8.2	11.5	9.0	4.4
E46900	SIGNALS, ALL TYPES	25.7	14.9	18.0	14.4
E51200	SIMULATORS, ALL TYPES	12.2	19.9	4.3	20.5
	CONVENTIONAL AMMUNITION TOTAL	2079.6	1927.6	1789.0	1927.0
	MISCELLANEOUS				
EB0016	AMMO COMPONENTS/SUPPORT, ALL TYPES	32.0	21.3	20.3	15.1
E77000	CAD/PAD		.5	2.5	2.3
EA0055	ITEMS LESS THAN $2.0M (MISC-AMMO)	10.7	11.0	5.2	8.3
EA0650	SPARES AND REPAIR PARTS	1.0		1.2	1.7
EA0575	AMMUNITION PECULIAR EQUIPMENT	.9	5.2	7.8	8.1
E64500	NITROGUANIDINE (LB)	27.7	25.0	23.2	24.8
EA0525	COMP A-5			12.2	12.5
EA0512	COMP C-4			9.5	9.8
EA0514	PBX 0280			3.8	3.9
EA0520	COMP LX-14			3.8	4.0
EA0523	HMX EXPL-805			5.7	5.9
EA0535	WAR RESERVE STOCKPILING (EXPL/PROPELLANT)	33.0			
EA8000	AMMO 9WW/ELT	1.7	1.7	1.6	2.9
	MISCELLANEOUS TOTAL	107.0	64.7	96.8	99.3
	PRODUCTION BASE SUPPORT				
EP1000	PROVISION OF INDUSTRIAL FACILITIES	282.5	280.6	159.0	300.5
EA0054	COMPONENTS FOR PROVE-OUT		14.0	8.7	16.4
EP2000	LAYAWAY OF INDUSTRIAL FACILITIES	19.5	20.5	22.9	19.7
EP4000	JEFFERSON PROVING GROUND MODERNIZATION		2.0	2.2	
EP4100	CHEMICAL DEMILITARIZATION PROGRAM		81.3		
EP1220	MODERNIZATION PROJECTS		103.1	161.1	
	PRODUCTION BASE SUPPORT TOTAL	302.0	501.5	353.9	336.6
	ARMY AMMUNITION PROCUREMENT APPROPRIATION TOTAL	2500.3	2497.2	2254.0	2424.0

OTHER PROCUREMENT , ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
D00200	CHASSIS TRAILER GEN 2 1/2 TON 2W M200A1	5.6	7.6	4.1	
D00800	CHASSIS, TRAILER, GP, 3 1/2, 2W, M353			3.7	
D01100	DOLLY SET, TRANS SHELTER, 2 1/2T, M720				3.3
D01300	DOLLY SET, TRANS SHELTER, 5 1/4T, M832				3.0
D00501	DOLLY SET, TRANS SHELTER, 7 1/2T, M1022	3.6	5.5	6.2	7.8
D15201	MOTORCYCLE, GED, 2W, ROUGH TERRAIN		2.0	7.1	7.8
D0[illegible]0	SEMITRAILER BB/CONT 22 1/2T M871 C/S	3.5			15.9
D01600	SEMITRAILER BB/CONT 34T M872 C/S		3.4	6.4	7.6
D01000	SEMITRAILER, LB, 12T M270A1-M269A1		9.3		
D00700	SEMITRAILER, LOW BED, 40T M870 (C/S)	3.2	12.2	1.9	15.2
D02400	SEMITRAILER, LOW BED HET, XM1000				32.8
D02300	SEMITRAILER, TANK, 5000G		19.8	8.8	8.5
D02700	SEMITRAILER, TANK, 7500G, BULKHAUL			7.3	10.3
D03200	SEMITRAILER, VAN ELECTRONIC 6T 2W M373A2				2.0
D04800	SEMITRAILER,VAN SUPPLY 12T, 2W, M129A2C			7.0	
D06200	TRAILER, CARGO 3/4T, 2W, M101A2 W/E		3.5	5.6	12.7
D06400	TRAILER, CARGO, 1 1/2T, 2W, M105A2	11.5	11.1		18.2
D05700	TRAILER, HEAVY, EXPANDED MOBILITY	4.7		7.4	8.3
D06800	TRAILER TANK WATER 400G 1 1/2T, 2W M149A1		4.0	5.9	18.4
D15400	HI MOB MULTI-PURP WHLD VEH (HMMWV) (MYP)	311.1	313.3	330.6	128.5
D11300	COMMERCIAL UTILITY AND CARGO VEHICLE	315.4			
D19000	SMALL UNIT SUPPORT VEHICLE (SUSV)		13.8	26.2	32.2
D14000	TRUCK, 5T, 6X6, ABT (MYP)	347.2	216.8		400.0
D16200	TRUCK, 10T, 8X8, ABT (MYP)	199.6	116.1	234.3	70.4
D15900	TRUCK, TRACTOR, LINE HAUL, M915A1				58.1
D16000	TRUCK, YARD TYPE, M878 (C/S)		3.1		
DA0925	MODIFICATION OF IN SERVICE EQUIPMENT	.8	1.5	3.8	15.5
G38900	SHOP EQUIPMENT, AUTO MAINT & REPAIR		.9	2.5	2.5
DL5110	ITEMS LESS THAN $2.0M (TAC VEH)	3.1	1.7	1.9	1.4
	TACTICAL VEHICLES TOTAL	1209.3	745.6	670.7	880.4
	NON-TACTICAL VEHICLES				
D23000	PASSENGER CARRYING VEHICLES	28.8	30.0	13.8	10.8
D24850	GENERAL PURPOSE VEHICLES	33.8	39.9	34.9	39.3
D25000	SPECIAL PURPOSE VEHICLES	10.5	13.0	9.7	14.0
	NON-TACTICAL VEHICLES TOTAL	73.1	82.9	58.4	64.1
	SUPPORT EQUIPMENT AND FACILITIES				
DA0350	SPARES AND REPAIR PARTS (TAC)	121.5	135.0	136.6	126.5
DA0400	PRODUCTION BASE SUPPORT (TAC)	3.2			1.8
	SUPPORT EQUIPMENT AND FACILITIES TOTAL	124.7	135.0	136.6	128.3
	TELECOMM EQUIP - READINESS COMMAND COMM				
BB5777	JCSE EQUIPMENT (USREDCOM)	4.7	.3	1.8	3.7
BZ9950	CINCS INITIATIVE			4.1	4.7
BB2000	CLASSIFIED PROJECT 9WW	24.4	14.2	9.1	8.2
	TELECOMM EQUIP - READINESS COMMAND TOTAL	29.1	14.5	15.0	16.6

OTHER PROCUREMENT , ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
	TELECOMM EQUIP - JOINT TACTICAL COMM PROG				
BA1055	MOD RCRD TFC TERM (MRTT)	18.3	29.3	31.9	41.3
BA1050	DIG GROUP MULTIPLEXER (DGM)	20.1	20.4	10.8	19.5
BA1045	RPTR/TERM ASSMBLGS	29.3	15.7	19.9	29.1
BA1040	RADIO TERMINALS AN/TRC-170	44.7	29.2	32.4	38.8
BA1035	MAINTENANCE SYSTEM AN/ARM-164			3.3	
BA1030	UNIT LEVEL SWITCHES		10.5	12.2	42.9
B69100	CON SYS CON EL AN/TYQ-16		15.9	23.6	33.6
B50400	DIG NSEC VTER TA-954	3.6	4.0	3.9	6.5
B72300	ANDVT_TAC TERM, CV_3591		4.0	3.9	5.3
B74402	LIGHTWEIGHT DIGITAL FACSIMILE	8.3		1.2	6.2
BB1610	MOB SUBSCRIBER EQUIP	63.3	335.3	903.7	1019.8
BB1600	MOD OF IN-SVC EQ (TRI-TAC)	39.6	22.5	9.9	14.4
	TELECOMM EQUIP-JOINT TAC COMM TOTAL	227.1	486.8	1056.7	1257.4
	TELECOMM EQUIP - COMBAT SUPPORT COMM				
BA0027	COMM SYS (HTLD)		8.5		
B00500	SINCGARS	121.0	102.1	204.0	309.0
K08200	DIGITAL DATA GENERATOR BOX SG-1139	4.1			
B13300	HAND CRANK GENERATOR, G-76			2.5	
BU0055	IHF RADIO MODS				14.6
BU8100	IMP HF RADIO FAMILY	29.7	26.6	11.1	11.6
Z15700	OPTICAL LONG HAUL TRAN SYS			9.3	11.0
B10500	PWR SUPPLY PP-6148/U		.9	4.0	2.7
B45200	PULSE FORM RESTORER TD-206	1.1			
B05300	RADIO SET AN/PRC-70		11.6		
BC2200	SOF MOD RADIOS			4.5	3.2
B45500	ANTENNA GROUP OE-254		2.5	6.5	5.2
B02600	SMALL UNIT TRANS AN/PRC-68		1.0		
W18300	SMALL UNIT TRANSCEIVER			3.7	7.0
B01300	STEER NULL ANT PROC, CP-1380		15.4		
B76000	TELETYPEWRITER TERMINAL AN/UGC-74	5.2	2.1		
B71100	VEHICULAR INTERCOM SYSTEM			10.2	13.3
BB1550	MOD OF IN SVC EQUIP (CSC)	28.0	18.9	26.4	20.6
BZ8250	RDF COMM (SW ASIA)	24.5	19.5	14.9	21.3
BL5220	ITEMS LESS THAN $2.0M (CSC-C-E)	6.6	7.1	5.9	4.6
BC2150	SPEC OPS COMM SUP ELMT		11.3	15.2	1.8
	TELECOMM COMBAT SPT EQUIP TOTAL	220.1	227.5	318.2	425.9
	TELECOMM EQUIP-NMCS WIDE SUPPORT COMM				
BA8110	SECURE CONFERENCING PROJECT	—	—	4.5	4.4
	TELECOMM EQUIP-NMCS WIDE SPT COMM TOTAL			4.5	4.4
	TELECOM EQUIP-STARCOM NON-DCS				
BU3770	AR TELECOM AUTO PR (ATCAP)	6.7	9.2	3.2	5.6
BU4160	C-E FACILITIES/PROJECTS	21.7	18.8	4.7	10.5
BU4000	SOUTHCOM C3 UPGRADE		13.8	16.0	15.4
BD3100	ELECTROMAG COMP PROG (EMCP)	.2	.6	.5	.6
	TELECOMM EQUIP-STARCOM NON-DCS TOTAL	28.6	42.4	24.4	32.1

OTHER PROCUREMENT , ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
	TELECOMM EQUIP-LONG HAUL COMM (DCS)				
BU0200	AUTODIN (DCS)	7.4	4.8		
BU0300	DEFENSE DATA NETWORK (DDN)	6.5	6.5		
BB4960	SECURE VOICE IMPRV PROG (SVIP)	.8			
BU3800	TRANSMISSION MEDIA (EUCOM)	11.9	16.2	11.1	12.9
BU3850	TRANSMISSION MEDIA (PACOM)	15.4	30.8	15.8	6.3
BU3610	WW TECH CON IMP PR (WWTCIP)	9.9	5.3	2.7	4.0
	TELECOMM EQUIP-LONG HAUL COMM TOTAL	51.9	63.6	29.6	23.2
	TELECOMM EQUIP-SATCOM-GND ENVIRON				
BB8501	DIGITAL EQUIPMENT (DSCS)	24.8	39.9	29.3	29.0
BB8504	INTERCONNECT FACILITY (DSCS)	8.7	7.9	2.2	4.9
BA8300	JAM RESISTANT SECURE COM (JRSC)	27.9	19.6	9.3	17.2
BB8507	MED SAT TERM AN/GSC	58.9	62.0		
BZ3500	SPRD SPEC MUL ACC(DSCS)	27.1	18.0		
BB8509	DSCS OPERATIONS CONTROL SYS (DOCS)	41.6	31.2	80.3	66.2
BB8416	MOD IN-SVC EQUIP (DSCS)	3.6	8.5		
K28900	MPK SAT UHF TERM, AN/PSC-3	1.9	3.9	5.0	5.0
K45900	VEH SAT UHF TERM, AN/VSC-7		1.4	1.4	1.4
K23700	SINGLE CHANNEL OBJECT TACT TERM (SCOTT)				32.7
BB8417	MOD IN-SVC EQUIP (TAC SAT)	42.8	53.3	7.0	4.5
	SATCOM-GND ENVIRONMENT TOTAL	237.3	245.7	134.5	160.9
	TELECOMM EQUIP-EUCOM C3 SYSTEM				
BB8422	EUCOM C3 (NWS)	48.0	98.6	68.4	16.7
BB8430	PACOM C3 (NWS)			13.0	15.0
BA8200	EUCOM ALTERNATE SPT HQ (ASH)	6.9	7.7	3.8	
BA8250	USAREUR C2 PROJECT			7.7	7.8
	TELECOMM EQUIP-EUCOM C3 SYSTEM TOTAL	54.9	106.3	92.9	39.5
	TELECOMM EQUIP-COMSEC EQUIPMENT				
T68000	AUTO KEY DC KGX-93/TSEC		4.3	4.1	4.2
BZ8950	SECURE VOICE IMPROVEMENT PROGRAM (COMSEC)	17.5	12.0	13.7	19.1
T53000	LOOP KEY GEN TSEC/KG-82	9.2	2.1		
T54000	DED LOOP ENCRYP DEV KG-84	14.4	31.8	18.7	19.9
T67500	TNK ENCRYP TSEC/KG-93		2.2	2.1	2.7
T02100	TSEC/KG-94	11.7	7.8	12.3	9.9
T05400	TSEC/KG-95 KEY GENERATOR	7.1			
T55000	INT LEV T SET TSEC/ST-34	1.5	.8		
T54500	DIG SUB VOICE TSEC/KY-68	3.6	2.0		
T88500	TSEC/KY-90	2.8	5.4		
T06200	KEY GENERATOR, TSEC/KG-87		2.0	1.8	1.3
T84500	KGV-6/TSEC	1.1			
T06400	COMSEC MODULE, TSEC/KGV-13		3.8	19.9	6.7
T99500	FREQ MODULE, KGV-10/TSEC	12.9	13.9	9.1	13.8
T5000	SPEECH SECURE EQ TSEC/KY-57	39.8	35.0		
T50500	SPEECH SECURE EQ TSEC/KY-58	5.1			
T90500	TSEC/KYV-5 (VACTOR) SECURE EQUIP		.9	.5	1.5
BQ0200	TEMPEST (COMSEC)	5.2	1.1	.7	1.2

OTHER PROCUREMENT , ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
T06300	KOK-13/TSEC (KDC)			1.9	.8
T01600	TSEC/KGV-8 (THORNTON) SECURE MODULE			.6	3.1
T88000	BERDAN KGV-9	4.4			
T03200	TSEC/KGV-11/SECURE MODULE		1.3	1.4	1.5
T87000	UMSTEAD CC (CI-11-1)	2.8	3.0		
T87500	UMSTEAD RT (CI-11-2)	2.1	6.8		
T92500	BATSON II, TSEC/CI-14		8.4		
BL5264	ITEMS LESS THAN $2.0M (COMSEC)	7.6	8.2	11.7	7.7
	TELECOMM EQUIP-COMSEC EQUIPMENT TOTAL	148.9	152.8	98.5	93.4
	TELECOMM EQUIP-BASE COMM				
BB8700	BASE COMM (CONUS)	35.8	34.5	35.8	36.9
BU4165	LOCAL AREA NETWORK (LAN)			1.7	10.6
BB8800	BASE COMM (EUCOM)	19.3	6.8	7.9	13.1
BB8900	BASE COMM (PACOM)	4.9	4.0	1.6	6.0
BU1130	DA COMD + COM SYS (DACCS)	3.6	10.3		
BU1200	ARMY OPNS CTR		5.0	4.3	
BQ0100	PENTAGON TELECOM CTR (PTC)	1.9	9.8	4.1	
	TELECOMM EQUIP-BASE COMM TOTAL	65.5	70.4	55.4	66.6
	TELECOMM EQUIP-TMDE				
BZ5270	TMDE MODERNIZATION	21.5	27.0	16.9	19.4
	TELECOMM EQUIP-TMDE TOTAL	21.5	27.0	16.9	19.4
	OTHER ELECT SYS/EQUIP-INTELLIGENCE SUPPORT				
BB2050	4TH PSYOP GROUP			12.5	11.1
K28800	ALL SOURCE ANALYSIS SYSTEM (ASAS)-TIARA				
V29600	COMMANDERS TACTICAL TERMINAL			14.7	
V07300	TRAILBLAZER	58.6	19.2		
BZ7315	TAC ELEC SURV SYS	19.3	15.8	4.0	3.5
K06800	MANPACK RADIO DF SYSTEM (MRDFS)		7.0	5.6	
V07800	TEAM PACK		6.0		
BZ9750	MOD IN SVCEQU (INT SPT) TIARA	48.7	20.2	37.3	35.9
BL5278	ITEMS LESS THAN $2.0M (INT-SPT-C-E)	3.7	5.6	.5	.1
BB6010	FT DEVENS TRAINING SUPPORT	13.5	.4	.4	.5
BA0326	TROJAN	2.9	9.2		
	OTHER ELECT SYS/EQUIP-INTEL SPT TOTAL	146.7	83.4	262.2	216.7
	OTHER ELECT SYS/EQUIP-GEN DEF INTEL PROG				
BD3900	INTELL DATA HANDLING SYS (IDHS)	14.2		23.0	
BZ8920	TECH RECON AND SURV SYS (TECRAS)	5.5		10.9	
BL5282	ITEMS LESS THAN $2.0M (FCI/S&IA-C-E)			1.1	
BL5283	ITEMS LESS THAN $2.0M (GDIP-C-E)	5.0		9.1	
	OTHER ELECT SYS/EQUIP-INTEL SPT TOTAL	24.7		44.1	
	OTHER ELECT SYS/EQUIP-AUTO DATA PROCESS SYS				
BD3970	VERT INSTL AUTO BASELINE (VIABLE-BASOPS)	33.7	18.7	41.8	36.7
BA2090	VIABLE INSTALLATIONS IN EUROPE & WESTCOM	8.7			
B78400	BATTERY COMPUTER SYSTEM	28.7	17.7	11.0	

OTHER PROCUREMENT , ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
BD3950	AMC FIVE YEAR ADP PROGRAM	4.9		4.0	5.0
B28600	ADV FIELD ARTILLERY TACT DATA SYS		25.6		10.7
BU1400	ARMY DATA DISTRIBUTION SYSTEM-ADDS		21.6	75.5	162.3
BZ9200	TRADOC AUTOMATION	9.9		3.7	1.9
BZ9300	USAREUR TACTICAL AUTOMATION		2.2	2.0	2.1
BD3955	LIFE CYCLE SOFTWARE SUP (LCSS)	1.0	3.5	9.1	6.5
BE4150	ADPE FOR NON TAC MGT INFO SYS	59.8	42.1	40.4	38.7
BE4152	SUPERCOMPUTERS			22.9	24.3
BE4154	ARMY CORPORATE DATABASE			.9	2.4
BE4156	SOLDIER DATA TAG				5.2
BE4158	PROJECT 80X PHASE II			12.9	17.4
BE4157	TRANS OF PERS PROP			2.9	1.2
BE4160	STD ARMY AUTO CONTRACT SY			6.8	6.8
B78301	DIGITAL MESSAGE DEVICE	12.0			
B83900	FIRE SUPPORT TEAM DIGITAL MESSAGE	14.5	17.2	17.0	5.6
BZ9851	FORWARD ENTRY DEVICE			12.0	17.9
BE4200	NON-CENTRALLY MANAGED ITEMS		105.3		
BA9300	MANEUVER CONTROL SYSTEM	27.9	59.9	56.9	57.4
BC1000	MOD IN SVC COMD/CONTROL (C2)		2.9		
BZ9350	CORPS/THEATER ADP SVC CTR (CTASC)	6.0		9.7	20.4
B62000	TACT ARMY CMBT COMPT SY (TACCS)	20.7	44.6	42.9	16.8
B40200	DECENTIZED AUTO SER SUP SYS MOD 'B'	38.2			
K99200	COMPUTER BALLISTICS: MORTAR XM-23	12.7	6.0		
BZ8889	CSS LOG APPLC AUTO MARK/READ SYMBS (LOG MARS)		10.6	11.4	12.3
BE4100	WWMCCS INFORMATION SYSTEM (WIS)	14.2	7.1	36.2	29.0
BZ8888	UNIT LEVEL COMPUTER (ULC)	2.2	5.5		
	OTHER ELECT SYS/EQUIP-ADP SYS	295.2	390.5	420.0	480.6
	OTHER ELECT SYS/EQUIP-AUDIO VISUAL				
BZ8480	AFRTS (AUDIO VISUAL)	4.1	7.8	8.0	6.7
BE1000	DIG STRG & RTRVL ENGRG DATA SYS (DSREDS)	4.8	24.3		
BL5298	ITEMS LESS THAN $2.0M (A/V-C-E)	12.7	11.3	9.1	17.6
	OTHER ELECT SYS/EQUIP-AUDIO VISUAL TOTAL	21.6	43.4	17.1	24.3
	OTHER ELECT SYS/EQUIP- ELECTRONIC WARFARE				
V02300	COUNTERMEASURES SER AN/TLQ-17A		5.7		5.8
V31100	JAMMER, HAND EMPLACED, EXPENDABLE				
V07200	TACJAM, AN/MLQ-34	32.0	19.0	33.0	
VV0255	TACTICAL DECEPTION (TAC-D)		5.2		
BA6100	MOD IN SVC EQUIP (EW)	12.6	2.1	8.3	19.3
BL5292	ITEMS LESS THAN $2.0M (EW-C-E)		2.9	.8	.8
	OTHER ELECT SYS/EQUIP-ELECT WARFARE TOTAL	44.6	34.9	42.1	66.3
	OTHER ELECT SYS/EQUIP-TACTICAL ELECTRONICS				
B81100	BATTERY CHARGER PP-7286/U	1.7	3.5	3.0	8.2
K02900	POWER SUPPLY, PP-6224	1.0	1.9	3.2	3.2
B92400	COMPUTER/INDICATOR, CP-696/PD		4.0	3.7	4.8
K27800	METEROLOGICAL DATA SYS (FAMAS)	33.6	33.0	32.8	33.7
B92000	GND/VEH LASER LOC DESIGNAT'R (G/VLLD)	45.0	45.0		

OTHER PROCUREMENT , ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
B81200	HAND HELD LASER RANGEFINDER AN/GVS-5	4.9		6.8	10.5
BZ7900	INTRUSION DETECTION DEVICES	26.8	16.6	20.8	7.0
K47800	NAVSTAR GLOBAL POSITIONING SYSTEM		9.7	5.2	9.9
M75700	POSITION/AZIMUTH DETERMINING SYS (PADS)		19.9	35.7	37.3
K37500	TAM-6 NIGHT SIGHT MAINTENANCE FACILITY	2.3	4.2		
K56900	AN/TAM-3 TEST SET, NIGHT VISION SIGHT	1.1	2.3		
K35500	NIGHT OBS DEVICE LONG RANGE AN/TAS-6				29.7
KA3500	NIGHT VISION GOGGLES	34.8	64.9	63.2	70.0
K41500	NIGHT VISION SIGHT INDIV WPN N/PVS-4	12.6	9.9	10.0	14.6
B26200	POS LOCATION REPORTING SYS (PLRS) (MYP)	50.3	45.1	4.0	
B43300	RADIAC SET,AN/VDR-2		2.0	4.0	6.3
BA9200	REMBASS-TIARA	21.1	22.0		
A02900	RPV TA/DESIGN AERIAL RECON SYS (TADARS)		21.9	117.7	193.3
BA1080	JOINT STARS (ARMY)			63.4	107.9
K71400	SHOP SHELTER MTD ASM-189			2.2	10.8
K71500	SHOP SHELTER MTD (STOR) AN/ASM-190				3.3
K71700	TEST SET, RADAR, AN/TPM-25	1.2			4.9
K10600	SHOP SHELTER MDT-REP AN/ASM-146			2.1	
BZ7325	MODIFICATION OF IN SVC EQUIP (TAC EL)		3.5	38.5	41.5
BL5295	ITEMS LESS THAN $2.0M (TACT ELEC-C-E)	7.9	9.5	8.4	9.6
	OTHER ELECT SYS/EQUIP-TACT ELECT TOTAL	244.3	318.9	424.7	606.5
	OTHER ELECT SYS/EQUIP-TMDE FOR TACTICAL ELECTRONICS				
K07900	TEST STA, ELECTRONIC EQUIP, AN/USM-410	5.2	8.9		
K18400	BASE SHOP TEST FACILITY				21.1
K51600	CONTACT TEST SET				7.3
M87001	TMDE FOR STE/ICE		5.6	6.5	7.7
M87003	CORE ELECTRONIC AUTO TEST (STE-X)		8.5	3.0	6.5
	ELECT SYS/EQUIP-TMDE FOR TAC ELECT TOTAL	5.2	23.0	9.5	42.6
	OTHER ELECT SYS/EQUIP-SUP EQUIP AND FAC				
BA9500	SP/REP PARTS (TELECOMM-C-E)	190.6	189.2	183.2	202.6
BA9700	SP/REP PART (COMSEC)	7.5	14.6	11.4	13.0
BA9600	SPARES AND REPAIR PARTS	155.4	205.0	260.3	308.9
BA9800	WAR RESERVE SPARES	8.0	18.0		
BF5500	SPECIAL PROGRAMS	50.7	95.0	115.8	208.5
BB9050	QUICK RETURN ON INVESTMENT (QRIP) PGM	1.1	.5		
BB9000	PRODUCTIVITY INVESTMENT FUNDING	27.1	40.7	31.1	.4
BB9051	PROD ENHANCING CAP INVESTMENT PROG (PECIP)		1.0	21.8	
BF5400	PRODUCTION BASE SUPPORT (C-E)	12.5	5.0	8.1	3.1
	SUPPORT EQUIP AND FACILTIES TOTAL	452.9	569.0	631.7	736.5
	CHEMICAL DEFENSIVE EQUIPMENT				
M96200	SIM DET CHEM AGENT AUTO ALARM XM81	1.2	4.7		
M67400	DECONTAMINATE APP PWR DR LT WT XM17	3.3	6.4	3.9	7.0
MA5000	MASK, PROTECTIVE, NBC	34.7	30.3	19.9	61.7
S02200	CHEMICAL AGENT MONITOR	7.8	19.4		19.6
M97400	SIMP COLL PROT EQUIP XM20		3.9	4.1	5.8
M98300	MODULAR/COLL PROT EQUIP FOR VV AND S	9.3	3.1		10.7

OTHER PROCUREMENT , ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
M98800	AUTO CHEMICAL AGENT ALARM (ACADA), XM22			9.0	7.1
M99104	GEN SET, SMOKE, MECH: PUL JET, XM157		4.2	7.0	
MA7000	MODS IN SVC (CHEM)	6.0			
	CHEMICAL DEFENSIVE EQUIPMENT TOTAL	62.3	72.0	43.9	111.9
	BRIDGING EQUIPMENT				
M23600	RIBBON BRIDGE ERECTION BOAT		25.4	19.2	18.9
M26600	BRIDGE, FLOAT RIBBON, INTERIOR BAY		7.1	7.2	7.5
M26700	BRIDGE, FLOAT RIBBON RAMP		3.8	3.2	3.5
M26800	BRIDGE, FLOAT RIBBON, TRANSPORTER	12.4	18.0	18.2	18.5
ML5315	ITEMS LESS THAN $2.0M (BRIDGING)	1.7	.9	1.3	1.8
	BRIDGING EQUIPMENT TOTAL	14.1	55.2	49.1	50.2
	ENGINEER (NON CONSTRUCTION) EQUIPMENT				
G27000	GEMSS AUX MINE DISPENSER XM138		2.0	3.9	4.0
G39100	DISPENSER MINE XM139			1.7	1.5
G22500	MIXER/PUMPER UNIT (MPU) TEXS				13.0
X00700	MARKING SYS, CLEAR LANE		3.0	3.2	2.0
M15300	E DET SET, MINE, MET/NON-MET, AN/PRS-8		8.1		5.6
M17900	DETECTING SET, MINE, AN/PSS-12			4.9	3.1
R06100	MINE PLOW			5.5	4.7
X00600	MINE CLEARING ROLLER	2.6	3.5	3.7	7.6
G00501	REMOTE CONTROL UNIT (MOPMS)		4.6	9.8	9.6
R20000	SURVEY SET DISTANCE MEASURING INFRARED	1.1		2.8	
M05900	M-9 ARMORED COMBAT EARTHMOVER (ACE) (MYP)	11.7	42.4	30.4	159.1
ML5320	ITEMS LESS THAN $2.0M (ENG NON-CONST)	1.8	3.3	.9	.9
	ENGINEER (NON CONSTRUCTION) EQUIP TOTAL	17.2	66.9	66.8	211.1
	COMBAT SERVICE SUPPORT EQUIPMENT				
MF9300	AIR CONDITIONERS VARIOUS SIZE/CAPACITIES	16.2	14.8	32.2	14.7
M86600	FIELD KITCHEN, MOBILE, TRL MTD		5.3	13.1	15.7
M86900	MODULAR FIELD KITCHEN			11.6	15.2
MA9500	DIVING EQUIPMENT	.7	.4	1.8	3.4
MA9600	FIRETRUCKS	8.9	9.0	16.0	13.7
M90900	HEATER DUCT TYPE, 250K/400K BTU				4.8
M87600	LAUNDRY UNIT/TRL MTD	2.6		7.3	7.0
MB2000	TAG PRINTING AND BINDING EQUIPMENT	4.6	5.4	4.3	5.2
ML5325	ITEMS LESS THAN $2.0M (CSS-EQ)	14.0	8.7	11.3	20.7
MA8100	MODIFICATIONS OF IN SVC EQUIPMENT (CSE)	1.4	3.8	8.9	5.0
	COMBAT SERVICE SUPPORT EQUIPMENT TOTAL	48.4	47.4	106.5	105.4
	PETROLEUM EQUIPMENT				
M19000	TANK ASSEMBLY FAB COLL POS 50000G	2.2	5.1	4.6	4.4
M64000	FORWARD AREA REFUELING EQUIPMENT			2.8	3.0
M64900	TANK ASSEMBLY FAB COLLAPSIBLE 10K G	10.8	5.8	6.6	7.9
R21400	TANK ASSEMBLY FAB COLL, 20K GAL POL			6.3	
M62300	TANK/PUMP UNIT LIQ DISP F/TRK MOUNTING	12.6		1.0	5.9
M73300	LABORATORY, PETROLEUM, SEMI-TRLR MTO			3.2	3.6
M63900	PUMP ASSEMBLY LIQ GAS WHL 4 IN OUT 350GPM	3.1	5.8	12.2	

OTHER PROCUREMENT , ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
M12700	PUMP CENTRIFUGAL 4X4 DED	7.6			
MA0260	PIPELINE FOR TUSA	22.0			
MA5120	SWA PETROLEUM DISTRIBUTION		38.9	39.3	43.4
ML5330	ITEMS LESS THAN $2.0M (POL)	2.1	3.5	6.7	3.4
	PETROLEUM EQUIPMENT TOTAL	60.3	59.1	82.7	71.6
	WATER EQUIPMENT				
M16600	WTR PUR UNIT REV OS 3000 GPH (ROWPU)		14.0	33.9	21.4
M18000	WATER PUR UNIT, REV OSMOSIS, 600GPH	10.6	24.0	29.5	36.8
M13500	WATER STOR AND DIST SYS 800K GAL	3.3			
M13300	WATER STOR DIST SYS 1.0M GAL	1.1			
M27400	TACTICAL WATER DISTR SYS	8.6	8.3		8.6
M18100	FWD AREA WTR POINT SUP SYSTEM	4.6			
M66000	TANK, FABRIC, COLL, WTR, 3K GAL (SMFT)	1.0			
M15000	TANK, FAB, COLL, 3K GAL WATER (ONION)			2.9	
M14100	TANK, FABRIC, COLL, WTR, SEMI-TRLR MTD 5M	2.2	1.6		
M15700	SMALL MOBILE WATER CHILLER (SMWC)	2.8	2.2	1.5	
R01400	DRILL MACH, WELL 600FT	1.5			
M15900	PUMP CENTRIFUGAL 65GPM		3.4	2.1	
ML5335	ITEMS LESS THAN $2.0M (WATER EQ)	6.1	1.9	2.5	4.8
	WATER EQUIPMENT TOTAL	41.7	55.4	72.4	71.6
	MEDICAL EQUIPMENT				
MB9700	DEPLOYABLE MEDICAL SYSTEM (DMS)	52.1	96.7	88.8	98.6
MA8045	CBT SUP EQUIP MEDICAL	50.6	98.7	48.1	53.6
MA9900	MEDICAL SUPPORT EQUIPMENT	49.8	83.9	70.8	104.6
	MEDICAL EQUIPMENT TOTAL	152.5	279.3	207.7	256.8
	MAINTENANCE EQUIPMENT				
M61500	SHOP EQ CONTACT MAINT TRK MTD (MYP)	20.4	27.0		12.2
M61500	SHOP EQ CONTACT MAINT TRK MTD ADV PROC	36.6			
M61900	SHOP EQUIPMENT, ORG REPAIR, TRK MTD	19.9			
M67000	WELDING SHOP, TRAILER MTD	10.0	9.8	9.7	9.8
M61600	SHOP EQ ELECTRICAL RPR SEMI-TRLR MTD	6.0	13.5	14.5	9.6
S60000	STEAM CLEANER			5.0	10.4
M63300	E WELDING MACHINE ELEC ARC 350AMP (CC-CP)			5.7	
MA9160	BUILDING, PRE-FAB, RELOCATABLE			1.2	1.2
MA0460	CALIBRATION SET SUPPORT	10.0	7.7	12.7	12.7
ML5345	ITEMS LESS THAN $2.0M (MAINT EQ)	9.5	9.5	10.3	10.9
	MAINTENANCE EQUIPMENT TOTAL	112.4	67.5	59.1	66.8
	CONSTRUCTION EQUIPMENT				
R03800	GRADER, ROAD MOTORIZED, HVY, 6X4 (CCE)	10.4			
M06400	LOADER, SCOOP TYPE, DD 4WHL, 2-1/2 CU YD	4.0			
M06100	TRACTOR FULL TRACKED LOW SPEED DD MED	11.9	26.4	73.6	
R04800	SMALL EMPLACEMENT EXCAVATOR (SEE)	28.2	25.3	25.0	36.3
R05000	CRANE, WHL MTD, HYDRAULIC 7 1/2 TON	25.7			14.2
M09800	COMPRESSOR, AIR ROTARY, 250 CFM, 100 PSI	14.0			
MA8300	MODS OF IN SVC EQUIP (CONST EQUIP)			.1	.2

OTHER PROCUREMENT , ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
ML5350	ITEMS LESS THAN $2.0M (CONST EQUIP)	2.0	6.0	.7	6.6
	CONSTRUCTION EQUIPMENT TOTAL	96.2	57.7	99.4	57.3
	RAIL FLOAT CONTAINERIZATION EQUIPMENT				
M34200	LANDING, CRAFT, UTILITY	15.7	22.9	29.3	25.2
M44600	TUG INLAND AND COASTAL WATERWAYS			30.1	
M11200	LOGISTIC SUPPORT VESSEL (LSV)	20.2		19.9	19.7
R09800	RO/RO DISCHARGE PLATFORM	11.6	11.2		
R97500	CAUSEWAY SYSTEMS	13.5	12.9	28.8	21.6
MA4029	ARAPAHO		5.0		
M39500	RAILWAY CAR, TANK, POL, 20000G			9.8	.1
M37300	RAILWAY CAR, FLAT, 140 TON	12.8			
M92000	SHIPPING CONTAINER	1.9			
MA8950	MODIFICATIONS OF IN-SVC EQU (FLOAT/RAIL)	7.4	1.0	5.7	13.6
ML5355	ITEMS LESS THAN $2.0M (FLOAT/RAIL)	.5	4.2	1.0	3.4
	RAIL/FLOAT CONTAINERIZATION EQUIP TOTAL	83.6	57.2	124.0	83.6
	GENERATORS				
MA9800	GEN AND ASSOCIATED EQUIP	104.1	90.0	115.9	115.2
	GENERATORS TOTAL	104.1	90.0	115.9	115.2
	MATERIAL HANDLING EQUIPMENT				
X50000	TRUCK, FORK LIFT, CBD, PT, 4000 LB	7.6		13.3	12.6
X51100	TRUCK, FORK LIFT, CBD, PT, 6000 LB	3.5	13.5	12.3	10.6
M48400	TRUCK, FORK LIFT, GE, SRT, 2000 LB		2.9		
M48800	TRUCK, FORK LIFT, DE PT, RT 10000 LB				33.7
M48900	TRUCK, FORK LIFT, DE, PT, RT, 6000 LB	.1		21.0	28.4
M49300	TRUCK, FORK LIFT, ELEC, SRT, 6000 LB	2.8	4.6		
M41100	TRUCX, FORK LIFT, ELEC, SRT FRT/SIDE LDR		2.0		
M49200	TRUCK, FORK LIFT, ELEC, SRT 4000 LB	4.4	12.9	1.7	
X00900	65 TON CRANE		6.2	42.6	42.7
ML5365	ITEMS LESS THAN $2.0M (MHE)	3.4	5.0	2.4	8.0
	MATERIAL HANDLING EQUIPMENT TOTAL	21.8	47.1	93.3	136.0
	OTHER SUPPORT EQUIPMENT				
MA0350	SPARES AND REPAIR PARTS (OTHER)	34.2	37.7	54.4	55.6
MB7000	BASE LEVEL COM'L EQUIPMENT	36.8			
MB2100	AREA ORIENTED DEPOT UPGRADE	37.4	83.2	60.5	
MA5550	PROD ENHANCING CAPITAL INVEST PRGM	2.9			
MA5500	QUICK RETURN ON INVESTMENT PROGRAM	15.0			
MA5730	PROJECT RESHAPE (HQ DARCOM)		6.0		
MA0450	PRODUCTION BASE SUPPORT (OTHER)	6.5	7.9	34.4	12.0
MA5600	OSD PRODUCTIVITY INVESTMENT FUNDING	.9		4.9	
MA6700	SPECIAL EQUIPMENT FOR USER TESTING	14.1	11.2	13.3	18.0
ML5390	ITEMS LESS THAN $2.0M (OTHER SPT EQ)	.6	.5	1.0	.9
MA5175	HOST NATION SUPPORT - EUROPE	17.7	41.0	41.9	18.2
MA6600	NATIONAL TRAINING CTR SUP		13.3	10.8	5.0
MA1300	SWA STAGING BASES		6.4		6.2
MA0100	TRAINING DEVICES, NONSYSTEM	139.9	177.8	186.1	235.4

OTHER PROCUREMENT , ARMY

SSN	ITEM NOMENCLATURE	FY85	FY86	FY87	FY88
MA9996	SPECIAL PROGRAMS	42.9			16.2
MB7101	BCE (NCMI)			61.6	42.5
MB7102	PECIP (NCMI)			6.5	7.4
MB7103	QRIP (NCMI)			9.1	10.3
	OTHER SUPPORT EQUIPMENT TOTAL	348.8	385.1	484.5	427.7
	OTHER PROCUREMENT, ARMY, TOTAL	4890.7	5240.3	6169.0	7189.9

WEDNESDAY, APRIL 9, 1986.

RESEARCH, DEVELOPMENT, TEST, AND EVALUATION, DEFENSE AGENCIES

INTRODUCTORY REMARKS

Mr. CHAPPELL. The committee will please come to order.

Pursuant to a motion duly made and passed, this hearing will be in executive session because of the classification of material to be discussed.

The committee this afternoon will receive testimony relevant to the fiscal year 1987 budget request of the Defense Agencies for RDT&E funds. Those agencies to be heard today include the Defense Nuclear Agency (DNA), the Defense Advanced Research Projects Agency (DARPA), and the Office of the Secretary of Defense.

Testimony on the Strategic Defense Initiative, which comprises over 50 percent of this budget account, will be received in a separate hearing next month.

The fiscal year 1987 budget for non-SDI programs totals $3.6 billion, which represents real growth of minus 4 percent over the fiscal year 1986 level adjusted for Gramm-Rudman.

Although the committee will be unable to cover the hundreds of projects in this account today, we will consider several major programs such as the National Aerospace Plane and NATO Cooperative Testing.

The witnesses today are Lt. Gen. John L. Pickitt, Director of DNA; Dr. Robert C. Duncan, Director of DARPA; Mr. John E. Krings, Director of Operational Test and Evaluation; and Dr. Joseph A. Navarro, Deputy Under Secretary of Defense for Developmental Test and Evaluation.

Gentlemen, the committee offers you a special welcome here today as you all appear before the committee for the first time. Your prepared statements will be placed into the record at the appropriate points. Due to time constraints, we are planning to allow approximately forty minutes each for DNA and DARPA, and twenty minutes each for Dr. Navarro and Mr. Krings, in that order.

DEFENSE NUCLEAR AGENCY

WITNESSES

LIEUTENANT GENERAL JOHN L. PICKITT, USAF, DIRECTOR
MARVIN C. ATKINS, DEPUTY DIRECTOR FOR SCIENCE AND TECHNOLOGY

Introductory Remarks

Mr. Chappell. General Pickitt, if you would like to summarize your statement briefly, please proceed.

Opening Statement of General Pickitt

General Pickitt. Thank you, Mr. Chairman, and members of the committee.

I am Lt. General John Pickitt, Director of the Defense Nuclear Agency. In order to be responsive to your interest and reduce the number of questions taken for the record, I have asked several key members of the DNA staff to participate today.

At the table with me today is Dr. Marvin Atkins, Deputy Director for Science and Technology.

If I may, I will take three or four minutes to provide my impressions of DNA and the impact that recent budget reductions have had on the effectiveness of our RDT&E program.

In response to the concerns expressed last year, Secretary Weinberger's report to your committee discussed the two DoD mission areas assigned to DNA, first, the nuclear weapons effects physics research involving blast and radiation phenomena as well as biomedical aspects, and second the user-oriented research and development that applies to the results of this nuclear weapons effects technology base for the benefit of our operational forces.

The DoD has deliberately combined these two thrusts of DNA for two reasons, first to assure that the nuclear weapons effects research efforts focus on critical defense requirements, the second to provide for the translation of this research and development into products that respond to the requirements of the defense organizations that make use of DNA products.

The quality of support provided by DNA has been impacted by recent budget constraints that affect all DoD programs. However, while the total DoD fiscal year 1987 budget shows real growth over fiscal year 1986, the DNA fiscal year 1987 budget reflects an austere level of funding that will not provide for support of all critical efforts.

In fact, DNA's fiscal year 1987 request has decreased in real terms after inflation by almost 5 percent.

Gramm-Rudman-Hollings will further impact our programs by reducing our fiscal year 1986 base an additional $33 million. These funding levels run counter to the DoD requirements for DNA support, such as for system validation and testing.

It is not possible under these fiscal constraints to fully maintain the internal balance to insure that all required current near-term and long-term issues are addressed.

For example, in the DNA underground and high explosive test programs, support has been reduced significantly for those efforts that ensure hardness of systems against nuclear effects. DNA support for strategic nuclear forces retains its characteristic two-thirds share of our fiscal program.

This results in the testing portion of our program being just over 41 percent. The technology base and systems support are, as a result of the reductions, slowly becoming smaller shares of the DNA program which jeopardizes the forward-looking thinking that is required to avoid technological surprises in the futures.

While the budgetary situation is serious, I am happy to report that our efforts to obtain the benefits of congressional and defense emphasis on competitive contracting has been extremely successful. Since 1984 we have achieved almost a five-fold increase in percentage of DNA contracts that are awarded competitively. In fiscal year 1986, more than one-third of our contracts will be awarded competitively and we expect the trend to continue in 1987 and beyond.

Gentlemen, DNA programs need your support in carrying out its mission.

This completes my overall statement, and I will be happy to address your questions.

[The statement and biography of General Pickitt follow:]

STATEMENT OF LIEUTENANT GENERAL JOHN L. PICKITT, USAF

Mr. Chairman and Members of the Committee:

I am Lieutenant General John L. Pickitt, Director of the Defense Nuclear Agency (DNA). It is a pleasure to appear before the subcommittee to report on DNA's progress over the last year and to discuss programs proposed for fiscal year (FY) 1987.

DNA's R&D programs provide essential support to our national policy of deterrence. In his recent report to the House Appropriations Committee, Secretary Weinberger discussed the two DoD mission areas that have been assigned to DNA:

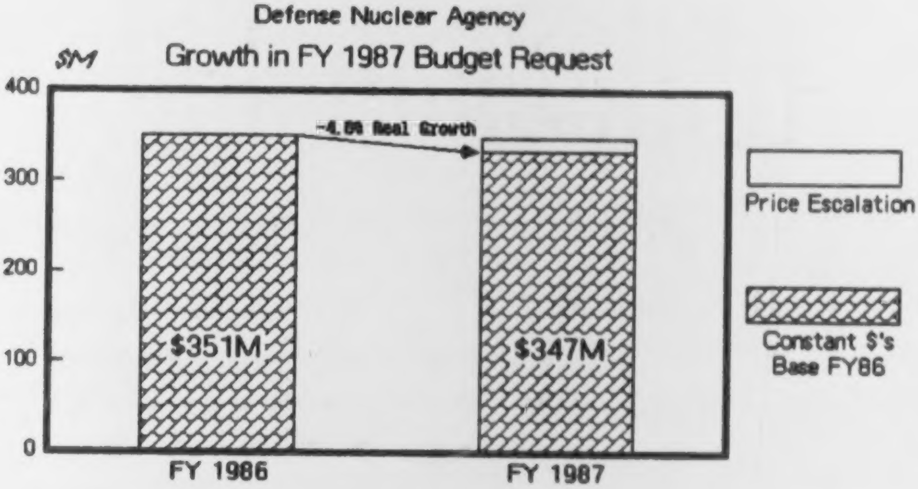
- Nuclear weapons effects physics research involving blast and radiation phenomena as well as biomedical R&D.
- User oriented R&D that applies the results of this nuclear weapons effects technology base to the benefit of our operational forces.

The Department of Defense has deliberately combined these two thrusts in DNA for two reasons; first, to ensure that the nuclear weapons effects research efforts focus on the most critical DoD requirements and, second, to provide for the translation of this R&D into products that fully respond to the requirements of the many DoD organizations that make use of DNA products.

My presentation today begins with a review of the DNA budget. I will then provide a selected survey of objectives and accomplishments in the DNA technology base programs.

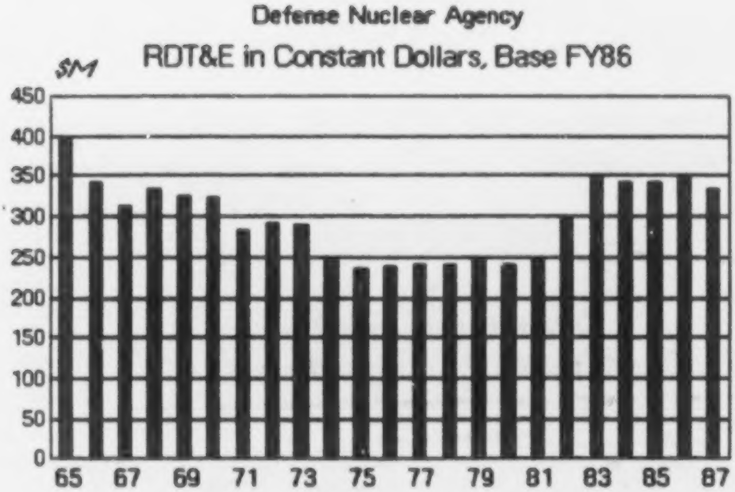
DNA's RDT&E PROGRAM

Shown below is the recent DNA fiscal picture. DNA's proposed RDT&E budget for Fiscal Year 1987 responds to the fiscal constraints that affect all DoD programs. These constraints translate into a FY 1987 program that is austere and only provides support for critical efforts.



Our proposed RDT&E budget for FY 87 entails a significant -- just under 5% in real dollar terms -- decrease from DNA's FY 1986 funding level of $351 million.

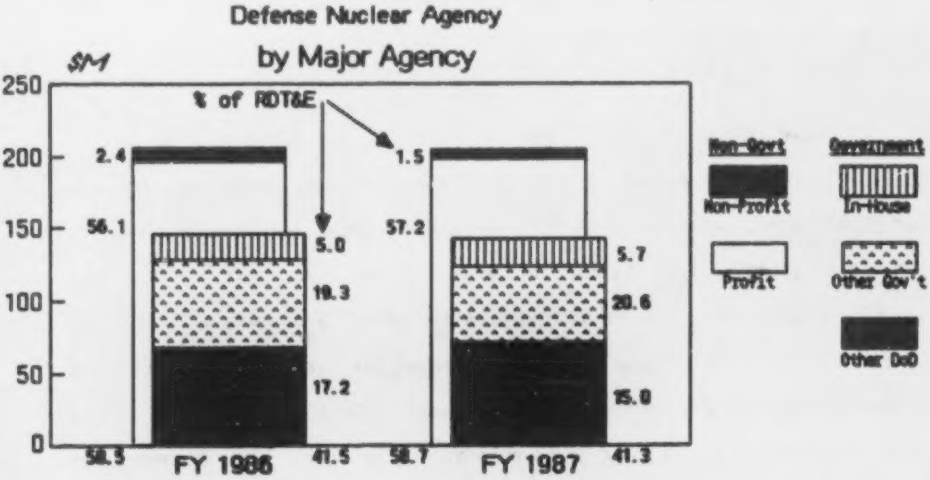
As shown in the next chart, our proposed level of RDT&E funding for FY 1987 is below our actual budgets for FYs 1983 through 1986. In developing our FY 87 budget, we have taken into account the impact which reductions in DNA R&D programs have on the customer organizations throughout DoD that make use of our products. After a thorough review of our programs, we have identified the baseline level of funding needed for our highly leveraged and responsive testing and technology base programs. Further reductions, over and above the reduction of almost 5% in constant dollar terms already programmed for FY 1987, would leave DNA resource limited and unable to respond to some of our DoD customers' mission essential requirements.



Defense Nuclear Agency

RDT&E in Constant Dollars, Base FY86

The next chart shows where we plan to allocate the RDT&E budget to accomplish our mission. Basic relationships remain unchanged between FY 1986 and FY 1987. This, in part, reflects the internal balance we impose on our research efforts to ensure that current, near-term, and long-term issues are addressed.



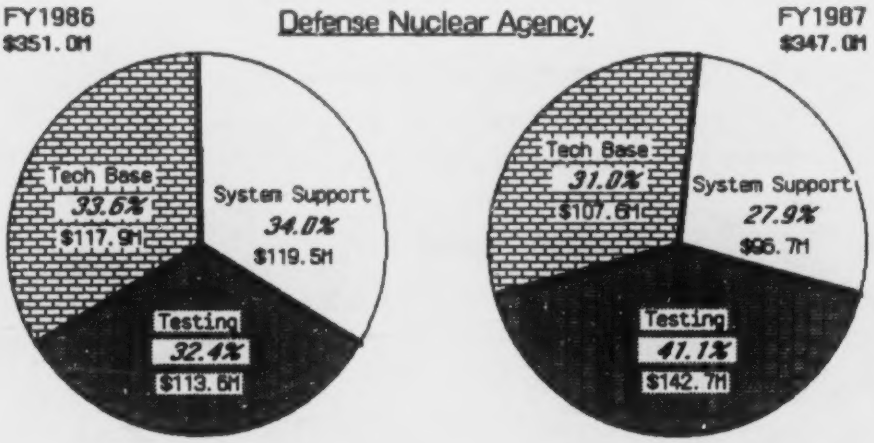
Defense Nuclear Agency

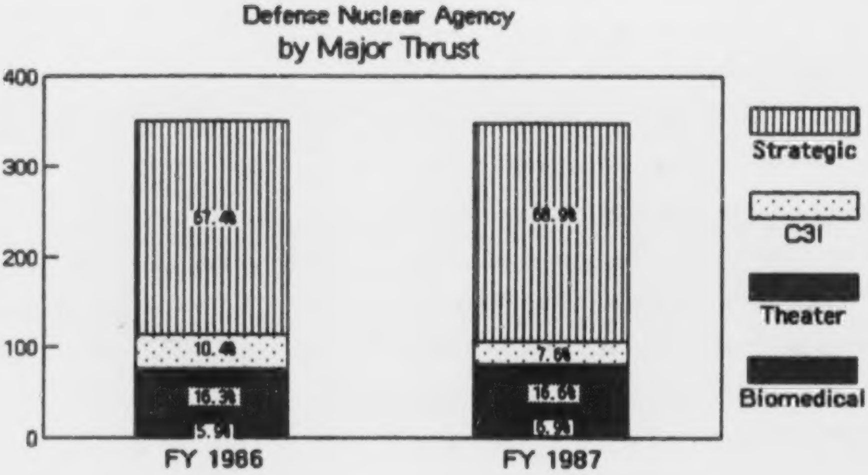
by Major Agency

In both our recent and projected programs, we have been responsive, to the maximum extent feasible, to the new emphasis which Congress and the DoD have placed on using competitive procurements. Meaningful competition was precluded by the fact that some of our efforts were already programmed as multi-year contracts and highly specialized disciplines are required for these programs. These factors affect the rate at which we can increase the percentage of our procurements which are made through competitive awards. Nevertheless, we have made significant progress. From FY 1984 to FY 1986, there has been a five-fold increase in the percentages of DNA procurements that have been competitive awards. We will continue this emphasis toward increased competition in FY 1987.

The next chart shows the focus of our efforts in FY 1987. The top graph provides the distribution of effort across test, technology base, and other (predominantly system support) activities. As is evident, most of our activities involve test programs and key technology base development projects.

The graphic on the next page provides a breakdown of FY 1987 effort in terms of strategic; nuclear force command, control, and communications; theater force; and biomedical programs. As has been characteristic of our programs in recent years, more than two-thirds of DNA's effort supports activities relating to the nuclear hardening and nuclear survivability of our strategic nuclear forces.





Defense Nuclear Agency
by Major Thrust

In developing the DNA RDT&E program, efforts are focused on high leverage projects. DNA's million dollar projects affect multi-billion dollar procurements of nuclear hardened systems. In looking for maximum leverage in the near-term, we do not, however, ignore the future. About one-third of our efforts are directed at the development of next-generation solutions.

Several criteria have been used to develop our FY 1987 research agenda:

- o How important is the problem for our national defense? In this regard, we give careful attention to the inputs we get from the many DoD organizations that are customers for DNA products.

- o Is the problem within our charter? Department of Defense Instruction 5105.31, and supplementary guidance provided by the Secretary of Defense, provide guidance here.

- o If the problem is within our tasking, are we the best qualified DoD activity to develop a solution? If the answer, in whole or part, is no, then we direct the problem to the attention of another DoD RDT&E activity or attempt to develop a joint program that brings all applicable expertise to bear.

- What will be the payoff for our DoD customers? As noted, we are looking for high leverage projects to maximize return on our RDT&E investments.

Quality control is a primary interest during the course of research in each DNA-funded project. Within DNA, a technical manager is assigned to oversee each project. DNA management carefully evaluates progress during program reviews. As DNA's Director, I personally review each project proposal prior to initiation, and also periodically review the status of ongoing efforts.

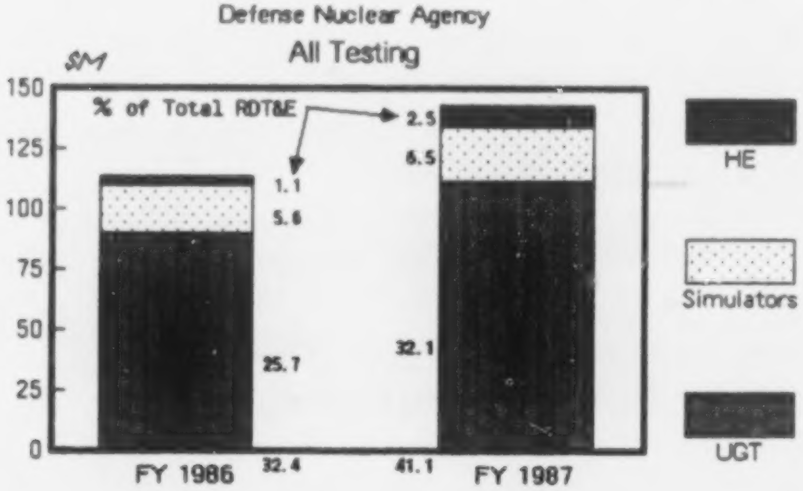
In addition, individuals and organizations external to DNA are also called upon to play a role in assuring quality in our programs. In accordance with our DoD-assigned charter, OSD offices and OJCS review DNA's RDT&E activities. Inputs are solicited from the customers who will make use of final products.

DNA RDT&E PROGRAM

I will briefly describe four important areas in the DNA RDT&E program: testing; support to our strategic forces; support to our non-strategic nuclear forces and, finally, some examples of the diversity of our technology transfer activities.

TESTING

Test activities, supplemented, where feasible, with simulators, are at the core of DNA's technology base programs. The chart shows the percentages of DNA's FY 1987 RDT&E effort that will be devoted to underground nuclear testing, high explosive (HE) tests, and radiation effects simulators.



Thirty-two percent of our FY 1987 RDT&E request is programmed for underground nuclear tests (UGT). DNA is the sole government agency chartered to manage UGT nuclear support effects tests on military systems, which we conduct in conjunction with the Department of Energy.

As the previous chart indicates, there is an increase in the UGT area in FY 87. This change in the level of the UGT program between FY 86 and FY 87 is attributable to the event execution schedule as well as the previously discussed significantly reduced FY 86 total budget as compared to FY 85 or our FY 87 request. Specifically, in FY 86 we executed MILL YARD and DIAMOND BEECH during the first month of the fiscal year which means the large construction costs were actually incurred in FY 85. In FY 87, the increase over FY 86 again reflects the impact of the schedule, where construction cost for MIDDLE NOTE, MISSION CYBER, MINERAL QUARRY, MISTY ECHO, and DISTANT DRUM are a major cost driver for the budget year and reflects the increase in the share of total RDT&E associated with the UGT program.

For many critical nuclear weapon effects issues, such as reentry vehicle (RV) hardness, there is no substitute for underground nuclear and high explosive testing. Selected examples of UGT and HE events with test objectives include:

MISTY RAIN (FY 1985)	UGT	Survivability of Mk 21 reentry vehicle for PEACEKEEPER, Small ICBM, and satellite components.
DIAMOND BEECH (FY 1986)	UGT	Validate new UGT concept to lower test bed yields.
MILL YARD (FY 1986)	UGT	Hardened silo cratering test.
MIGHTY OAK (FY 1986)	UGT	TRIDENT II components.
MIDDLE NOTE (FY 1987)	UGT	Key tests for TRIDENT II
MISSION CYBER (FY 1987)	UGT	and its Mk 5 reentry vehicle.
MISTY PICTURE (FY 1987)	HE	Dust erosion effects on reentry vehicles

Results, developed in the UGT program, are complemented with the data developed in DNA's High Explosive tests and through our nuclear effects simulator programs. I will make reference to these aspects of our test programs in the strategic and theater forces discussion provided later in this presentation.

DNA PROGRAM IN SUPPORT OF STRATEGIC FORCES

Research, in support of strategic forces, makes up over 68% of DNA's RDT&E budget in FY 1987. Major program thrusts include hardening technology for Intercontinental Ballistic Missile Basing Options, Strategic Missile

Inflight Survivability, Manned Aircraft and Cruise Missile Survivability, Strategic Nuclear Weapon Effectiveness, and Strategic Command and Control Survivability.

In my testimony today, I briefly discuss selected accomplishments and R&D objectives in these areas.

ICBM BASING

In cooperation with the Air Force, DNA is developing more survivable basing for both the Small ICBM and PEACEKEEPER.

For the Small ICBM, design of the Hardened Mobile Launcher (HML) has been affected by a major uncertainty in our understanding of the so-called non-ideal airblast created when a nuclear blast wave interacts with flat, barren terrain such as that found in potential basing areas in the southwestern United States. DNA has developed a detailed understanding of non-ideal airblast phenomena. Our activities have included development of innovative test beds for HML airblast testing. The data and assessments that we have developed have been provided to the Air Force for use in its Small ICBM program. We anticipate completion of this effort in FY 1986.

The Scrowcroft Commission recommended a technology development effort for potential basing of both PEACEKEEPER and the Small ICBM in superhard silos, a recommendation subsequently approved by Congress. In a joint program with the Air Force, DNA has reexamined nuclear cratering, developed improved test techniques, and investigated innovative techniques for enhancing silo and shock isolation system survivability. Specific efforts have included a reassessment of Pacific craters produced during the Atmospheric Test Program, special high explosive tests, and the MINI JADE and MILL YARD underground nuclear tests. Correlation of results from these efforts has provided the data base needed to support Air Force tests of silo vulnerabilities. A current objective is to determine whether structures surrounding silos can favorably alter shock characteristics to enhance silo hardness independent of site geology, and to design innovative shock isolation systems. The Intelligence Community continually uses the fruits of this work in their assessments of foreign systems.

Strategic Missile Inflight Survivability

DNA extensively supports R&D efforts to provide strategic missile designers with the data and techniques needed to improve inflight survivability.

A major activity involves development of laboratory test facilities. The DNA AURORA facility provides pulses of ionizing radiation emulating gamma ray effects in objects with dimensions typical of missile guidance systems. We also operate the ARES facility which is capable of exposing entire missile bodies to a threat level electromagnetic pulse. The schedule for these facilities in fiscal years 1986 and 1987 include radiation testing of PEACEKEEPER, TRIDENT II, and the Small ICBM at AURORA. The full-scale PEACEKEEPER missile is programmed in FY 1986 for electromagnetic pulse tests, to be followed in FY 1987 with similar TRIDENT tests at ARES.

In conjunction with the Department of Energy, we conduct underground nuclear tests, which are the most realistic way available today to simulate missile and reentry vehicle performance in nuclear environments. The MIGHTY OAK event, scheduled for April 1986, will include Mk 21 reentry vehicles and elements of the TRIDENT II missile and its Mk 5 reentry body, and hardware for the Small ICBM. During FY 1987, we will conduct the MIDDLE NOTE and MISSION CYBER events, which will be key tests of the TRIDENT II and Mk 5.

Another missile inflight survivability R&D thrust focuses on reentry vehicles. A key concern here is the effects of dust erosion on reentry vehicle heat shields. Erosion can seriously degrade accuracy or cause a loss of heat shield integrity. During the MISTY PICTURE event in FY 1987, we plan to conduct an experiment that should provide a pragmatic measure of dust erosion effects. We plan to continue our efforts to predict the location, concentration, and size distribution of dust lofted by nuclear explosions. Resolution of this issue is needed to reduce uncertainties in reentry vehicle fratricide from the dual U. S. perspective of both defender and attacker. DNA also conducts investigations of reentry vehicle antenna windows to improve their responses to x-ray deposition and to improve the survivability of the large windows that may be needed for maneuvering reentry vehicles.

Manned Aircraft and Cruise Missile Survivability

During volcanic eruptions in Washington State and in Indonesia a few years ago, aircraft engine malfunctions caused by dust ingestion were observed. We were tasked by the Office of the Secretary of Defense to determine implications of these effects for aircraft which must operate in a nuclear environment. In FY 1987, DNA will assess the vulnerabilities of advanced turbofan engines to dust environments associated with nuclear detonations.

Another initiative in this area develops automated techniques to locate and measure the radioactive intensity of nuclear clouds. Strategic planners need this information in order to plan flight paths. In FY 1986, we will begin to rehost software programs that perform these functions to microcomputers, making them more readily available to mission planners.

Strategic Nuclear Weapons Effectiveness

Changes in Soviet strategic force targets have prompted us to investigate alternatives for enhancing nuclear weapon effects against hardened Soviet underground structures, for example, military command centers. One approach uses proximity fuzes; a second program deals with earth penetrating nuclear weapons. With regard to earth penetrators, recent DNA research indicates that even very shallow penetrations can dramatically increase effects on targets. Hence, some of the weight penalties associated with previous designs that required very deep penetrations may be avoided. Over the next two years, we will refine these calculations and seek corroborative data during an underground nuclear test.

Complementing these efforts to improve our electronic-oriented C^3 research are our activities to improve strategic force employment planning. To this end, we are helping the JCS automate the strategic planning processes for the Joint Strategic Target Planning Staff and the Strategic Air Command. For example, in FY 1987, we anticipate demonstrating software that will allow rapid retargeting of aircraft and missiles.

Strategic Command, Control, and Communications

Deterrence requires that key command and control capabilities be capable of surviving the full range of nuclear weapon effects. Three initiatives are being pursued.

An aggressive program on high altitude nuclear effects on communications and radars is being pursued. The highlights of this program include evaluating current and proposed systems, developing nuclear resistant C^3 and radar methods, and developing system specifications and test techniques for nuclear environment survivability. These efforts are supported by work to reduce uncertainties in nuclear environment predictions, including a high latitude field program centered around the HiLat and Polar BEAR Satellites and a laboratory program simulating the early effects following very high altitude nuclear detonations.

In other efforts, DNA develops techniques to improve the survivability of satellites and associated technologies. We are currently assisting a number of satellite program offices to help them develop more survivable space and ground segments for their systems. Also, DNA hardening technology is keeping pace with the rapidly expanding microelectronic industry.

DNA has pioneered the methods used in hardening the electronic pieceparts used in many of our strategic systems today and provided the technology leadership in demonstrating viable hardening procedures for the very important Very High Speed Integrated Circuit (VHSIC) program vital to space as well as SDI applications.

In the area of High Altitude Electromagnetic Pulse (HEMP) research, DNA is developing cost effective methods for hardening communications facilities, providing system designers with reliable standards and specifications for EMP hardening, and has recently initiated a program to assure that HEMP hardness remains effective over the life cycle of the system.

DNA PROGRAMS IN SUPPORT OF NON-STRATEGIC NUCLEAR FORCES

Approximately 16% of our FY 1987 program develops products for use in the European and Pacific theaters. These efforts improve the survivability, security, and control of nuclear forces and weapons, and enhance nulear employment planning.

Survivability, Security, and Control

DNA's survivability programs address all components of the theater nuclear force. For example, since FY 1985 we have been cooperating with the Army in a major PERSHING missile program that enhances the survivability of all aspects of PERSHING basing and operations. Candidate improvements in hardware and procedures will be evaluated in a major series of field tests to be conducted in FY 1986/1987. Similar assessments have been initiated for LANCE and Ground Launch Cruise Missiles, with field trials scheduled for both systems in FY 1987.

Several FY 1987 projects will improve the survivability of nuclear weapons storage and transportation. A program plan developed by DNA for NATO's Senior Level Weapons Protection Group will be refined. Innovative storage techniques, initially developed for implementation in Europe, will be adapted for application in the Pacific theater.

DNA's technology base programs address theater force survivability issues. These include:

- Airblast testing of tactical equipment scheduled for the FY 1987 high explosive event.
- Use of the DNA-developed Thermal Radiation Simulator (TRS) to evaluate the thermal protection provided by current tactical equipment, coatings, and clothing.
- Modification, in FY 1986, of the AURORA laboratory radiation simulator to accommodate the Abrams tank and Bradley fighting vehicle.
- Development, in cooperation with the Navy, of the EMPRESS II EMP simulator, which is scheduled to begin operation in FY 1987.

As part of the FY 1985 military exercises in Europe, we demonstrated a microcomputer based C^3 system that enabled major reductions in the time required to plan and execute simulated tactical nuclear missions. In FYs 1986 and 1987, we plan to develop and demonstrate in Europe a highly survivable ground wave communications system with a low probability of intercept and mobile capabilities permitting dispersal for nuclear survivability. Beginning in FY 1986, and continuing into 1987, is development of a survivable communications system to process battlefield information and nuclear targeting data. This effort is an extension of our earlier work to reduce the time required for tactical nuclear mission planning and execution.

Nuclear Employment Planning

DNA has had considerable success in programs that develop, evaluate, and demonstrate new approaches for theater force command and planning. Building on these accomplishments, in FY 1987, DNA will demonstrate an automated nuclear planning system for an Allied Tactical Operations Center (ATOC). This system will build on a previously developed automated system that optimizes planning for Army Corps nuclear forces. We will also support potential improvements to the nuclear weapon planning capabilities at the SHAPE and other Allied headquarters.

On-going projects, scheduled for completion in FY 1987, address Warsaw Pact forces' vulnerabilities to both Non-Strategic Nuclear and Advanced Conventional Weapons. These analyses will enable DoD and Allied organizations to select the best mixes of state-of-the-art munitions, and to develop plans that make the best possible use of all theater force capabilities, nuclear and non-nuclear.

TECHNOLOGY TRANSFER

In DNA's projects, emphasis is placed on transfering results from assessments and tests to our many DoD customers. Examples of such technology transfers to strategic and theater forces are described in subsequent sections of this presentation. In addition, a few of DNA's technology transfer programs merit special emphasis because they illustrate the diversity of DNA's responsiveness to the requirements of a wide range of DoD organizations.

The first is a set of projects which DNA has initiated to assist DoD elements that are responding to Department of Defense Instruction 4245.4, which requires that nuclear survivability be one of the points considered in the acquisition of new major and non-major systems with critical missions. We are working with concerned OSD and Service offices and developing products that transfer the information and tools that these elements need in order to develop state-of-the-art survivable systems.

In a second program area, DNA develops the products that are DoD references for nuclear effects information and calculations. This includes publication of EM-1, the core reference document for nuclear effects information; sponsorship of DASIAC -- the DoD Nuclear Information Analysis Center; and dissemination of computer programs for nuclear effects calculations.

A third thrust is exemplified by one of DNA's subordinate organizations -- the Armed Forces Radiobiology Research Institute -- addresses the biomedical effects that might affect combat performance, and develops and transfers to the Services methods for mitigating these effects. Another biomedically-oriented component of DNA's program is a cooperative effort involving the Veterans Administration and other agencies that reconstructs the radiation doses that were received by participants in the atmospheric test program.

A fourth example of DNA's ability to transfer technology to other areas of concern are those investigations of global environmental effects that might result from a major nuclear exchange. DNA's development of atmospheric physics and thermal effects technology is intended to resolve some of the major uncertainties associated with the global environmental effects phenomenon. In the current fiscal year, we are initiating experiments to collect data from large wildland fires to develop a better thermal effects database that will help to reduce present uncertainties. We will continue to participate in DoD-wide programs that address potential global climatic effects.

CONCLUSION

In my testimony today, Mr. Chairman, I have outlined Defense Nuclear Agency RDT&E programs that make critical contributions to our national policy of deterrence. These programs develop and apply the technology base that supports strategic and theater nuclear forces. At this point, I complete my prepared statement. I would be happy to address any questions you might have.

LIEUTENANT GENERAL JOHN L. PICKITT

DIRECTOR, DEFENSE NUCLEAR AGENCY

Lieutenant General John L. Pickitt is Director, Defense Nuclear Agency.

General Pickitt was born July 30, 1933, in Teague, Texas, and grew up in Gilmer, Texas. He attended Kilgore Junior College before entering the U.S. Military Academy at West Point, NY, in 1951. He graduated with a bachelor of science degree and was commissioned a second lieutenant in the U.S. Air Force in 1955. He earned a master of science degree in aeronautical engineering in 1961 through the Air Force Institute of Technology program at Wright-Patterson Air Force Base, Ohio. The general completed Air Command and Staff College in 1965 and the Industrial College of the Armed Forces in 1973.

In August 1955, General Pickitt entered primary pilot training at Marianna Air Force Base, Florida, proceeding to basic pilot training in February 1956 at Greenville Air Force Base, Mississippi. He then remained at Greenville as an instructor pilot.

He was named chief of Air Force Systems Command's Liquid Rocket Section at Holloman Air Force Base, New Mexico, in August 1961. Following graduation from Air Command and Staff College in June 1965, he was assigned to the Office of the Deputy Chief of Staff for Plans, Headquarters Air Training Command, Randolph Air Force Base, Texas. In February 1967, he transferred to MacDill Air Force Base, Florida, for F-4 combat crew training. In August 1967, General Pickitt joined the 366th Tactical Fighter Wing, Da Nang Air Base, Republic of Vietnam, as an F-4 aircraft commander. He flew 161 combat missions, 100 of them over North Vietnam. Upon returning to the United States, he was assigned to the air-to-air study group of the Fighter Division in the Office of the Assistant Chief of Staff for Studies and Analyses, Headquarters U.S. Air Force, Washington, D.C., from April 1968 to July 1972.

The general graduated from the Industrial College of the Armed Forces in June 1973 and was assigned to the 474th Tactical Fighter Wing at Nellis Air Force Base, Nevada, as assistant deputy commander for operations. In January 1974, he became wing deputy commander for operations and in February 1975 the wing's vice commander.

He moved to Langley Air Force Base, Virginia, in May 1975 as special assistant to the commander of Tactical Air Command. He served in that capacity until July 1976 when he became commander of the 2nd Aircraft Delivery Group at Langley. General Pickitt transferred to Mountain Home Air Force Base, Idaho, in January 1977 and served as commander of the 366th Tactical Fighter Wing. In July 1978, he became commander of Tactical Training Luke, later designated 832nd Air Division, Luke Air Force Base, Arizona. The general returned to Headquarters Tactical Air Command, Langley

Air Force Base, in January 1980, where he served as assistant deputy chief of staff for plans and then as deputy chief of staff for plans. He became deputy commander of Tactical Air Command and commander of air defense forces in 1981 and served in that capacity until May 1983 when he moved to the Republic of Korea to serve as Deputy Commander in Chief, United Nations Command; Chief of Staff of the Republic of Korea/United States Combined Forces Command; and Deputy Commander of United States Forces Korea. He assumed his present duties in June 1985.

General Pickitt is a command pilot with more than 4,000 flying hours in fighter aircraft which includes F-4s, F-5s, F-15s, F-104s, F-106s and F-111s. His military decorations and awards include the Defense Distinguished Service Medal, Air Force Distinguished Service Medal, Legion of Merit with two oak leaf clusters, Distinguished Flying Cross with 12 oak leaf clusters, Air Force Commendation Medal with one oak leaf cluster and Air Force Outstanding Unit Award Ribbon with "V" device.

He was promoted to lieutenant general June 1, 1983, with same date of rank.

General Pickitt is married to the former Mary Kay Oseland of New York City. They have two children: John and Patricia. General Pickitt's hometown is Gilmer, Texas.

MANAGEMENT ISSUES

UNSOLICITED PROPOSALS

Mr. **CHAPPELL.** Gentlemen, in May 1984 DNA officials stated before this committee that improvements would be made in DNA's contracting procedures for studies and analyses, including the reduction of awards based upon unsolicited proposals and increases in competition.

A series of audits dating back to 1981 had continually revealed problems in this area.

Do you consider unsolicited proposals as a method of competition?

General **PICKITT.** I do not.

Mr. **CHAPPELL.** Virtually all of the $11 million in fiscal year 1983 funding for studies and analyses was awarded on the basis of unsolicited proposals from contractors. Is the majority of funding for studies still being awarded based on unsolicited proposals? I believe you said a third at the present time.

General **PICKITT.** We are expecting 35 percent this year to be on competition and 45 percent next year. We are on schedule to make that 35 percent at this time unless the budget reductions shave some of it towards the end of the year so there is a significant increase in that sense in competition, and at the same time there is a measurable decrease at this point in the year in the number of contracts that have been based on sole source.

I believe last year it was 126 and this year it looks like 86.

Dr. **ATKINS.** If I may add on the subject of unsolicited proposals per se, we are anticipating this fiscal year only a handful of unsolicited proposals. Almost all the sole source awards mentioned are made on the basis of solicited sole source proposals where we have for good and sufficient reason selected a single source, but we have drawn up the work statement and solicited the proposal ourselves.

Certainly a small number of unsolicited proposals are not only legitimate but form the mechanism by which we can receive ideas from industry, from the academic world, and I believe that no studies and analyses this year are being awarded on the basis of unsolicited proposals.

CONTRACT NEGOTIATIONS

Mr. **CHAPPELL.** There is some criticism about the fact that you conducted some contract negotiations by telephone. Is that a fact, and if so, are there advantages to it?

Dr. **ATKINS.** There are advantages.

We conduct contract negotiations on the telephone only in the manner in which I believe every procurement office in the United States Government does. There are many times when what is called a negotiation is in fact very straightforward, simply a revalidation that the overhead rates are the same that they were the previous month and so forth.

Negotiations like that are indeed carried out on the telephone, which is the most cost-effective way to do it, and there is no problem whatsoever. It is perfectly standard practice in most if not all procurement operations.

REPORT TIMELINESS

Mr. **Chappell**. In response to the criticism that final reports from these contracts are often difficult to locate, DNA has recently stated that when time is of the essence, DNA allows contractors to provide verbal briefings instead of formal written reports.

Would you elaborate on this practice?

General **Pickitt**. That is no longer an acceptable standard. We will take briefings for interim status reports, but we not only expect a written report, we expect written reports that are validated, documented and can be both filed and distributed.

Mr. **Chappell**. Can you state the dollar value of all DNA contracts which were awarded based upon telephone negotiations, for fiscal year 1981 through fiscal year 1987.

General **Pickitt**. We may have to provide that for the record.

[The information follows:]

DNA does not have data identifying whether a contract was negotiated telephonically or face to face. To our knowledge, no Government agency keeps such data.

Mr. **Chappell**. Please answer the following questions for the record.

[**Clerk's note**.—Questions submitted by Mr. Chappell and the answers thereto follow:]

UNSOLICITED PROPOSALS

Question. Provide the total funding executed or planned for studies and analysis in FY 1984 through FY 1987, as well as the dollar value of such awards based upon unsolicited proposals. Provide the same data as above for all DNA contracts.

Answer. The following is in response to the above:

a. Total funding for studies and analysis.

Fiscal year:	*Thousands*
1984	$7,155
1985	10,054
1986	6,000
1987	7,770

b. Estimated dollar value of studies and analysis resulting from unsolicited proposals:

Fiscal year:	*Thousands*
1984	$6,800
1985	958
1986	0
1987	0

c. Total DNA RDT&E funding, all contracts:

Fiscal year:	*Thousands*
1984	$191,056
1985	177,086
1986	186,024
1987	203,876

d. Dollar value of all DNA contracts, including RDT&E, resulting from unsolicited proposals:

Fiscal year:	*Thousands*
1984	$118,115
1985	49,704
1986 (through February 1986)	893
1987	([1])

[1] No estimates.

e. These estimates illustrate the significant decreases in the proportion of DNA contracting dollars resulting from unsolicited proposals over the last three fiscal years. This is a matter of continuing management attention within the Agency.

ATTRITION RATE OF CONTRACTING OFFICERS

Question. What is the annual attrition rate of DNA contracting officers, and how has this varied over the past three years?

Answer. In the last three years, DNA lost two Contracting Officers, both to retirement. Annual attrition rates since FY 1983 of Contract Specialists, are: FY 1983—25 percent; FY 1984—7 percent; FY 1985—16 percent; FY 1986—11 percent.

After a significantly high turnover rate in 1983, the attrition rate has been at about the level considered normal for a procurement office. The Government-wide attrition rate for the GS–1102 series is about 12 percent.

There has been a significant growth of 58 percent in the DNA procurement workforce over this period. This has been in response to increases in both the number of actions handled and the complexity of the procurements.

All losses during this period, with one exception, have been to private industry or retirement. The six losses to private industry appear to have been related to the significantly higher pay available to some GS–1102-type procurement specialists outside Government.

LABORATORY FUNDING

Question. What is the dollar value of DNA funding for FY 1987 which is to be allocated to DoD laboratories, and how does this compare to such funding in previous years?

Answer. In Fiscal Year 1987, $52.2 million is allocated for DoD laboratories which is 15 percent of DNA's RDT&E program; in Fiscal Year 1986, $60.3 million is allocated for DoD laboratories which is 17 percent of DNA's RDT&E program; and in Fiscal Year 1985, $67.2 million was funded for DoD laboratories which was 20 percent of DNA's RDT&E program.

[CLERK'S NOTE.—End of questions submitted by Mr. Chappell.]

SCIENTIFIC ADVISORY GROUP ON EFFECTS (SAGE)

Mr. CHAPPELL. The Scientific Advisory Group on Effects (SAGE) was established to assist DNA in policy development and program planning. This group of up to 16 members includes representatives of contractors who benefit financially from DNA'S work.

In 1984, the S&I staff reported that "to permit representatives of contractors involved in performing studies for DNA to, in any way, influence DNA's operations and management gives the appearance of a conflict of interest and should be avoided."

Do you believe this poses an actual or potential conflict of interest?

General PICKITT. I do not believe under the safeguards established that it does.

Mr. CHAPPELL. Why?

General PICKITT. We start by first trying to be very selective in the individuals that are solicited to join the group. Second, they are briefed thoroughly by legal counsel on the implications of conflict of interest and then they are provided with written documentation to review and sign. Then we maintain cognizance of the types of meetings that they attended themselves, sir, so that if someone is from corporation X and we are looking at nuclear effects on a particular area that is in that corporation's contract, they frequently will not attend.

Mr. CHAPPELL. Is SAGE still in existence?

General PICKITT. Yes.

Mr. CHAPPELL. So you could still have some of those contractors who were involved as a part of SAGE?

General PICKITT. A representative of SAGE may be employed by a contractor with which we have contracts, but we have about 8 or 9 hundred contracts, contractors with 1300 or 1400 contracts active over a given period of time. To refuse to take anyone that is from any of those corporations would unnecessarily restrict the candidates that we could consider for advice and suggestions when there is available a reasonable way to prevent conflict of interest, because all 16 members do not have to attend every meeting.

Mr. CHAPPELL. Mr. McDade.

CONTRACTING FOR MANAGEMENT ASSISTANCE

Mr. MCDADE. Thank you, and I want to extend my welcome to the witnesses.

The 1984 S&I report also described the existence of a DNA contract conducted by a member of SAGE to assess the content and balance of DNA's RDT&E program, as well as handle ad hoc requests for management assistance.

The S&I team warned against this practice, citing past criticisms about agencies using management studies as a substitute for good internal management practices.

Does DNA still contract out some management activities?

Dr. ATKINS. Sir, I would submit that we have never had management studies done by the contractor who is being discussed there. I am very aware of the contract which the S&I staff looked at.

Mr. MCDADE. They say management assistance, Doctor.

Dr. ATKINS. That contractor provides ad hoc technical evaluations for us under a very strict conflict of interest clause in their contract. It is a two-page, closely typed statement which very tightly restricts them from making any use of any information which they get from that work in competing with other contractors or in submitting unsolicited proposals to DNA.

That contract is of great assistance to us in providing services of a fair fraction of the most senior people in the nuclear business in the country, and is to my mind worth far more to the taxpayers than it costs, and it is totally free of conflict of interest problems.

We have never——

Mr. McDade. Are you disagreeing with the S&I recommendation?

Dr. Atkins. I am disagreeing with their recommendation that that group of experts should never have a member on our SAGE. At the present time we have a nomination in for review and approval by the Office of the Secretary of Defense for a senior staff member from that company. We have evaluated his credentials and conflict of interest problem fully ourselves, and certainly the Office of the Secretary of Defense will do the same thing.

We do not feel there is any conflict of interest present in this situation.

Mr. McDade. Do you think it is a good management practice?

Dr. Atkins. I certainly recognize, sir, that there is a potential problem of perception that this is a bad thing to do. I would point out that we have never had a protest, certainly not a formal protest, to my knowledge not even an informal protest, from any other contractor about the existence of these situations.

Mr. McDade. Well, you have one from the S&I staff of this committee, which recommends that you don't do it any more.

Dr. Atkins. Yes, sir, I recognize that.

Mr. McDade. I am reading from page four of their report in which they talk about a system that has been called "even a contract for management", this is what they are saying: "DNA has several contracts with one contractor to perform management services for DNA."

"The current contract includes a requirement that the contractor help the DNA assess content, balance, emphasis, et cetera, of key DNA research projects."

"Also included are such tasks as providing a pool of senior staff to undertake studies an on ad hoc basis on a broad range of subjects, and provide DNA with a framework for planning and programmatic decisions."

"DNA paid about $1.05 million for this management service in fiscal year 1983. One of the major criticisms of the study contracts is the tendency to use them as a substitute for good internal management practices."

Dr. Atkins. Sir, I would agree with almost all of the factual statements that they made there, but not with the conclusion that this is a management services contract. I would call this advice from, as I said earlier, some of the most senior and most experienced people in the nuclear weapons field who have honorably served the country for decades and I think the taxpayers are getting a very good deal in obtaining the benefit of their services in this matter.

Mr. McDade. You are saying it is not management—what is it then? What do you call it?

Dr. Atkins. It is scientific advice and assistance to us in evaluation of new ideas and suggesting, for example, competing approaches, within our own staff, in such areas as how to do underground tests better in the future.

INTELLIGENCE DATA

Mr. McDade. The S&I team also found in February 1984 that the DNA was involved in the development of finished intelligence data which is prohibited by Presidential directive. They go on to say there was serious concern caused in the Intelligence Community and although the report stated that DIA is satisfied that DNA is no longer producing intelligence data, a February 1986 report of the Inspector General of the Defense Department has found DNA is still indeed producing finished intelligence data and that DNA coordination with the Intelligence Community is poor.

Do you agree, or disagree, with that statement?

General Pickitt. Let me try that one for size, sir, if I may. I agree that the coordination needed to be improved at that time. I believe that the coordination has been improved with General Perroots, not to say there is some kind of personality involvement that can be used to advantage, but we have known and worked with each other for many years and we have both been actively engaged in this since we have each come to these two agencies.

Mr. McDade. General, are you still producing intelligence data?

General Pickitt. We produce intelligence information because we are asked to. We in fact do many things at DIA's specific request. To not do so would deny——

Mr. McDade. What is the Presidential directive? Our staff says there was a Presidential directive that says you shall not produce finished intelligence data.

General Pickett. Perhaps the issue is the word "finished".

Mr. McDade. Could be.

General Pickitt. That would say, I believe, it is a misunderstanding in the definition of terms.

Mr. McDade. OK.

General Pickitt. Because DIA has not maintained the technical expertise for the last forty years in nuclear weapons effects that the country has decided to vest in DNA. DIA requests DNA support when they face one of those efforts.

We will do the study and we should properly provide that to DIA for their review, validation and distribution. So we provide the support.

Mr. McDade. Can you tell the committee that every report you furnish to DIA is one they requested or that every intelligence report that you drew up is requested by DIA?

General Pickitt. I can tell the committee they have been coordinated, and they are reviewed and validated by DIA, and distributed under DIA. The reason I can not answer the question specifically as you term it is that I have had personal cognizance of an issue that came up that DNA identified and requested DIA assistance on.

So DIA responded and we now have a joint effort. I am not quibbling with you, but I know I initiated it and I know General Perroots said it should be mine, and let's do it. I am not sure if that meets your term of DIA requesting me to do it.

Mr. McDade. Well——

General Pickitt. I am not trying to complicate it.

Mr. McDade. It sounds very complicated.

General PICKITT. Let me see if I can explain it by a scenario.

Defense Nuclear Agency is responsible for the safety, security and surety of the nuclear weapons force, so we inspect worldwide and are responsible for building the criteria and structure for protection of those weapons worldwide.

When you consider terrorist activities, there is a need for information on them, and how they might function, and become a threat. I then make my requirement known to DIA. DIA accepts that requirement but they need to have the information from DNA which has the responsibility for what and where the weapons are stored, and how they are inspected worldwide for every organization.

It gets to be a joint effort, but the result——

Mr. MCDADE. Here is a statement made just a couple months ago by the S&I team. I beg your pardon, this is the DoDIG. "Intelligence-related research efforts performed by contractors for the Defense Nuclear Agency and resulting draft reports often were not coordinated with or validated by the Defense Intelligence Agency."

That is the IG speaking to us and to you.

General PICKETT. Yes, sir, that is a true statement and that condition no longer exists. That statement bears on the time in the past and that no longer exists.

Mr. MCDADE. You have cured all these problems?

General PICKITT. I better have, sir.

Mr. MCDADE Indeed. We hope you did, General. We want you to.

Dr. ATKINS. I respectfully submit, sir, that that report makes a good working relationship sound bad. Somehow they made a very cooperative working relationship between two agencies sound like it was a mess, and it is not.

Mr. MCDADE. Why don't you elaborate a little bit, Doctor, tell me what you mean.

Dr. ATKINS. The report categorizes as intelligence production a number of efforts we have which are strictly nuclear weapons effects research being carried out for intelligence applications.

In our mind these work areas are 99 percent physics research, structural engineering research in silos, whatever. They are directed toward providing Defense Intelligence Agency and other elements of the Intelligence Community the technical information they need to make their intelligence evaluations.

The Inspector General's office looked at these items and, if they could see any intelligence content there, they tended to say DNA is doing intelligence. And we were unable to argue them out of that position. I think they are dead wrong.

Mr. MCDADE. We hear what you are saying and we will be keeping a close watch.

EMP HARDENING PROGRAM

Mr. MCDADE. An October 1984 audit of DNA's Electromagnetic Pulse, EMP, hardening program concluded that "the DNA had relinquished control of the program to a number of contractors" and that "the contractors recommending technical tasks for the program were also performing those tasks."

What has DNA done to correct these problems? What do you want to say about EMP, Doctor, General? Are you familiar with that?

Dr. Atkins. I am familiar with the history. I was educated on the history, although it happened before either one of us were in the agency.

The events that are in question occurred in 1982. At that time as I understand it, the management staff in the EMP research staff of DNA had, through a series of accidents, transfers, resignations, and so on, been reduced to almost zero at a time when there was great pressure on the agency from the Office of the Secretary of Defense to produce a lot of work in the EMP area.

The people left running the program felt they had no choice except to obtain advice of a technical nature from the contractors working on the program. There wasn't anybody else in the agency to do it, through a series of accidents.

Certainly the management decisions, the contracting decisions, were made by government personnel. I don't believe there was and is any serious question about that.

Mr. McDade. You have no similar situation now?

Dr. Atkins. No, that is all straightened out. I am confident it was a one-time event.

Mr. McDade. I have another question I would like you to answer for the record.

[Clerk's note.—The question submitted by Mr. McDade and the answer thereto follows:]

PERSPECTIVE ON MOBILE ICBM DEVELOPMENT

Question. General Pickitt, in your testimony, you discuss how DNA has played a significant role in determining requirements for the Midgetman. In particular, DNA has done a lot of work in looking at what kind of mobile launch system is needed—the size of the vehicle, its hardness against nuclear attack, etc.

As you know, some senior officials in DOD are saying that we should abandon the single warhead Midgetman for a MIRV'd missile. If we were to do this, the missile would have to become much larger and heavier—perhaps more difficult to make mobile. Especially if you want the launcher hardened.

Has DNA looked at the pros and cons of a single warhead Midgetman versus a larger, MIRV'd system? Can you give us your thoughts on this issue?

Answer. No, DNA's role is to assist the Air Force Ballistic Missile Office Small ICBM Program Office in select aspects of survivability through nuclear hardening and physical security technology. DNA performed neither life cycle cost versus configuration nor weight versus mobility trade studies.

[Clerk's note.—End of question's submitted for the record.]

Mr. McDade. Thank you, Mr. Chairman.

Mr. Chappell. Mr. Murtha.

Mr. Murtha. No questions.

Mr. Chappell. Mr. Young.

Mr. Young. No questions.

Mr. Chappell. Mr. Dicks.

SILO HARDENING

Mr. **Dicks**. Can you tell me about the work you have done on silo hardening?

General **Pickitt**. We have made tremendous progress in the last few years, both in basic understanding of the technology and phenomenology associated with both design and hardening.

This probably can best be described by comparison: in the past there was the belief that nothing could survive close to the explosion itself, we are now confident that a silo cannot only survive relatively close, but it can probably survive right up to the edge of the crater with continued research and development.

Dr. **Atkins**. The country's whole current state of knowledge in superhard silos evolved from work that DNA was doing ———.

Mr. **Dicks**. Okay.

Dr. **Atkins**. Everything the Air Force has done in the silo area in the last few years evolved from DNA technology, and we still participate heavily.

Mr. **Dicks**. I am advised that recent studies by DNA indicate that ———. Is this correct, and if so what implications does it have for the survivability of a missile force based in superhard silos?

Dr. **Atkins**. The statement certainly is correct. ———.

We have a very large amount of new data from several sources ranging from underground nuclear tests last year to going back and drilling in the craters from the atmospheric tests in the Pacific atolls and so forth.

The implications are that superhard silos can be designed to survive with confidence at approximately the ——— PSI level.

Mr. **Dicks**. What are our best estimates on when the Soviets might achieve accuracies sufficient to place a missile silo in the crater of an explosion ———.

General **Pickitt**. I don't have that.

Dr. **Atkins**. Sir, the Intelligence Community would have to provide those estimates, but I believe that they would tell you in the ——— something like that. ———.

Mr. **Dicks**. You have done some other work on in-flight survivability. Would you highlight that a little bit. Warheads in flight? This is an important part of the SDI program as I understand it.

General **Pickitt**. Yes, it is also an important part——

Mr. **Dicks**. Part of our own survivability.

General **Pickitt**. Part of our own survivability, and the lethality side of SDI. Major portions of the underground test programs are designed to expose both components and entire systems to the kind of radiation that comes from a nuclear explosion. Approximately ——— channels of data are taken on almost every test. In the recent past tests were dedicated to the better understanding of system survivability in the nuclear environment which it could be exposed to.

Mr. **Dicks**. One of the major issues we face is the fact the Soviets are ——— doing a lot of things in terms of command and control and leadership. Recently I was out at Sandia and was advised there and at Los Alamos about earth penetrators and the importance of that technology.

Would you describe why that is important in terms of being able to reach ———?

General PICKITT. There are two elements. We are learning that the shallow penetrator can give you an effect through the geology to much deeper levels and we are also learning from that same type of research there are ways to use them in patterns that will give you a much deeper weapons effect than we had realized in the past.

Dr. ATKINS. If a ——— weapon detonates at 20 feet above the ground surface, only one or two tenths of a percent of the energy is coupled effectively into the ground and creates the ground shock which can destroy targets like that. If that same bomb detonates at the surface of the ground, 3 or 4 percent of the energy will go into the ground. If you have an earth penetrating weapon that can get that bomb down even ——— below the surface, then the fraction of coupling goes up ——— percent.

So a penetrating weapon is much more effective in attacking deep area targets. We are working very hard on these problems. We have the lead on the effects side of that problem; you mentioned the Los Alamos and Livermore people, Los Alamos was in our office last week talking about it and Sandia the week before. Livermore Labs is heavily involved in that work also. We are working very closely as one integrated team.

HIGH ALTITUDE NUCLEAR EFFECTS

Mr. DICKS. You have been tasked to do an aggressive study on the high altitude nuclear effects on communication and radars. That is apparently being done.

Mr. ATKINS. Yes.

Mr. DICKS. One suggestion has been that the Soviets might use those kinds of tactics against our own satellites or any kind of space-based futuristic weapons systems.

Can you describe some of the work you are doing and what kind of interpretation you can give at this point about survivability of these kinds of assets?

Mr. ATKINS. Yes, sir. We are doing both laboratory experiments and very advanced theoretical calculations.

We are using some of the most sophisticated computer codes in existence to calculate the location of the radio energy absorbing plasmas in the upper atmosphere the way they separate into striations in the rows of plasma and further degrade the radio signals.

We confirm those laboratory experiments and theoretical calculations with field experiments every two or three years when we have a field campaign.

And we perform experiments like releasing barium at high altitudes in the upper atmosphere to simulate the same kind of plasma formation and break up of plasmas.

We are working closely with SAC and with the several program offices at Air Force Space Division ———. We are also talking with SDI to some extent, although they are really not far enough along in their hardware concepts at this point, but they are certainly well aware of our work and the potential problem here, problems that have to be circumvented.

Mr. Dicks. Thank you, Mr. Chairman.

Mr. Chappell. Mr. Miller.

SILO HARDENING

Mr. Miller. I have only one question. I did ask the group here before about the "carry hard" basing mode for the MX and silo hardening. There would be ——— inside the silos. I wonder whether you have worked on that particular project, because it seems you would have more to do with it than anybody else that has been in the room so far.

Mr. Atkins. Yes, sir, we have done some calculations on that approach and we are working with the Air Force, with the Ballistic Missile Office and Air Force Headquarters here in Washington, who were just on the floor in this room.

We are still working up exactly what the fiscal year 1986 program is going to be in that area. I would have to say that one of the limitations of that concept is that for very hard silos, where the attacking weapons have to be close, most of the shock loading comes downward and not sideways from ground motion.

So the ——— approach does not protect you well from the vertical motions.

Mr. Miller. Are you saying that the present Minuteman silos would have to be removed completely, ———?

Mr. Atkins. Sir, I don't know specifically. We will have to answer that for the record.

Mr. Miller. If you can. I would appreciate that.

[The information follows:]

Upgrading an existing silo is the responsibility of the Air Force. DNA provides nuclear load, engineering analysis methods, and simulation test technology, but not the construction design and planning. DNA has neither made, nor intends to make, an upgrading proposal wherein existing Minuteman silos would have to be removed. We understand that any upgrade plan would leave existing Minuteman silos in place.

Dr. Atkins. We would try that, yes, sir.

Mr. Miller. Thank you, Mr. Chairman. No other questions.

Mr. Chappell. Mr. Young.

Mr. Young. No, Mr. Chairman.

PHYSICAL SECURITY

Mr. Chappell. Let me ask you one question. Let's take Bangor, Maine, and the Trident base in Georgia. What kind of security do you have on nuclear weapons?

General Pickitt. I think we have excellent security, sir. We check and the Services check. There are about 3 to 5 depending on the type of organization that specifically on repetitive basis tests, exercise, not only for management and leadership but the full mechanism from the base facilities through training and qualifications.

The DNA has a mandatory check of once every five years of every unit in the armed services associated with them. Each Service has inspection teams. The DNA also inspects the Services' inspection teams and does over the shoulders with them in addition. Then the commands within the Services have their own training and inspection capability that they run about every 18 months as a maximum and then within the commands of your subordinate elements and divisions or however they are divided up.

The problem you have in the field in one of those units, is praying that the people will let you get your training done so that you keep qualifying, because otherwise you can find yourself hosting inspectors on almost a continuous basis.

That is kind of the operational side of it.

The other portion is the DNA maintains a set of folders in which there are three in existence, from every installation that possesses a nuclear weapon or component worldwide. They are updated. We have at about ——— percent level of completion that entire library, so that you can both review and analyze design proposals for changing, for modernization, assess weaknesses, and if there is a problem that you have the complete background in order to go about working on it.

Mr. CHAPPELL. For example, what size force do you have protecting the two Trident bases?

General PICKITT. I don't know the answer to that. We can provide it for the record.

[The information follows:]

According to information received from the Physical Security Officer at the West Coast Trident facility, there are a total of 53 marines assigned to the total guard force. There are a minimum of 19 marines on site at all times. The East Coast Trident Base is still under construction, with no marines presently assigned to provide the guard force.

Mr. DICKS. If the Chairman would yield, I was two days ago at the Trident base, it is not in Maine, it is in the great State of Washington.

Mr. CHAPPELL. I meant Washington.

Mr. DICKS. I know you did, and I know you wanted to correct the record. It is a slight oversight. We have not given it back. That would be two East Coast bases. That would be wrong.

Mr. CHAPPELL. Let the record be corrected. Bangor in Washington.

Mr. DICKS. I was very impressed with their security. They had two outer fences, an inner fence and cameras all the way around. They had Marine Corps detachments there raised up in high level structures where they can observe and they had buildings that were very secure.

I thought it was——

General PICKITT. The fences are instrumented and there are detection devices also provided to provide warning.

Mr. DICKS. Yes, with layer after layer of security.

Mr. CHAPPELL. Is most of that done by contract security or by Service people?

General PICKITT. Service people, sir.

Mr. DICKS. These are Marines.

Mr. CHAPPELL. Are there any proposed changes in that?

General PICKITT. No, sir. It is set up so you have the outer perimeter of defense and ———.

[CLERK'S NOTE.—Classified discussion removed.]

Mr. DICKS. Will the Chairman yield for a question?

Mr. CHAPPELL. Yes.

UNDERGROUND NUCLEAR EFFECTS TESTING

Mr. **Dicks**. You do a lot of work with nuclear testing. Nuclear testing has become a big issue in the Congress.

Tell me what kind of limitations it would put on your organization if there was a comprehensive test ban treaty?

General **Pickitt**. The three major impacts are, one, there would be no further development of new nuclear weapons. So we would be unable to do the research that developed and refined new weapons so we would be denied that future improvement as part of the national defense.

We would be restricted to the weapons now available rather than new developments that technology could be developing.

The second impact we would suffer is a gradual growing lack of confidence in the nuclear stockpile that exists in our inventory today. The reactivity of the components that make up the nuclear weapon, because of their inherent reactivity, needs to be tested in order to validate that they have maintained their stability and that there has not been a gradual deterioration and reduction in yield or reliability of some major element.

The only way one can do that with confidence is to test.

The third impact we would suffer is we would be denied the development of defense mechanisms against enemy weapons.

So there would be a three-pronged bad impact on our national defense effort.

Mr. **Dicks**. Explain that last one again.

General **Pickitt**. The Soviets have had a massive testing program going on for many years,———.

They have built up a large background and data base. The last time they broke out of the test ban it was one of the more massive amounts of nuclear testing achieved. They have the data base to fall back on.

We are doing tests at the rate of about ——— and those are the tests that give us the survivability and the information to harden a warhead, command and control and satellites for communication, so they can survive a nuclear environment if necessary. We would be stopped where we are at the time that such test ban went into effect.

Mr. **Murtha**. How do you compare the number of tests that the Russians have held versus the tests that we have held, say, in the last ten years?

General **Pickitt**. I don't have the number in my head.

[Clerk's note.—Classified discussion removed.]

Mr. **Chappell**. Let's place the remainder of the questions in the record at this point for your answers, and we will move to DARPA.

[Clerk's note.—Questions submitted by Mr. Chappell and the answers thereto follow:]

PHYSICAL SECURITY

Question. General. DNA's role in physical security development is focused on threats to nuclear weapons. However, many of the projects being conducted appear to be only peripherally related to nuclear weapons security. These include development of: ———.

Would the primary application of these efforts be toward protection of nuclear weapons?

Answer. Yes. The primary application of our R&D efforts in physical security is to enhance the security posture of our nuclear weapons. ———.

Question. A portion of this effort involves studies and analyses, with such titles as "adversary testing" and "future look." Could these studies be funded out of other sums appropriated for DoD studies and anaylses?

Answer. Only one of these two activities is properly categorized as a "study." ———.

This activity has proven to be a highly valuable evaluation tool. The purpose of the "future look" research effort is to identify measures that will enhance the security and survivability of nuclear weapons against future threats. This work will begin as a study and analysis effort to conceive meaningful survivability and security concepts, but will transition to prototype test and evaluation.

Question. Why did DNA combine the Physical Security Project into other work in Fiscal Year 1987?

Answer. DNA combined the Physical Security Project with the former Theater Nuclear Forces Survivability, Security, and Safety Project to form a single Nuclear Survivability and Security Project. This action was based on the interrelationship between security and survivability and the concomitant need to coordinate survivability, security and safety research activities as they cover the full spectrum (warheads, delivery systems, C^3, and logistics) and nuclear forces.

Question. How much funding is being requested for this work in Fiscal Year 1987, and how much is planned for Fiscal Year 1988?

Answer. DNA has budgeted $9.45 million in Fiscal Year 1987 and programmed $6.5 million in Fiscal Year 1988 for the Nuclear Security Program.

Question. What percentage of the Physical Security program for Fiscal Year 1987 is the result of DNA initiative, and how does this compare to Fiscal Year 1985 and Fiscal Year 1986?

Answer. DNA initiatives accounted for approximately 35 percent of the Fiscal Year 1985 physical security R&D effort. For Fiscal Year 1986 and Fiscal Year 1987, the percentage is in the order of 20 percent for each year.

Question. How does DNA ensure that their physical security activities are not duplicated by service efforts?

Answer. DOD Directive 3224.3, "Physical Security Equipment: Assignment of Responsibility for Research, Engineering, Procurement, Installation, and Maintenance," dated 1 December 1976, assigns DNA to be the DoD focal point for all exploratory research and development of physical security equipment. As a result, DNA funds all Exploratory Research and Development on DoD physical security projects. The Services are assigned responsibility for pursuing the output of DNA-funded research into advanced development. The DoD Directive precludes the Services from duplicating DNA work in this area.

Question. How many times has the Physical Security Equipment Action Group in OSD met in the past year?

Answer. According to the Chairman, the group met approximately 10 times in 1985.

Question. How many times each year does this group formally meet?

Answer. Basically, the group meets on an as required basis at the call of the OSD chairman, or at the request of one of the Service representatives. Past history indicates that the group meets at least 15 times per year. In addition, the Physical Security Equipment Action Group meets annually to formally review the Physical Security research programs conducted by the Services and DNA.

UNDERGROUND NUCLEAR TESTING

Question. The DNA is requesting an increase of 24 percent in funds to support the Underground Nuclear Testing program in FY 1987. However, even with these increased funds, one less test will be conducted than is planned for FY 1986. Why is this?

Answer. Costs to plan, design and construct a test bed for an underground test are usually spread across three or more years, with the bulk of the cost occurring in the years prior to the year in which the event is actually executed; for instance, FY 1986 costs associated with the ——— events executed in that year account for only 11 percent of the underground test event budget for that year. This practice is necessitated by the sequential steps in the building and executing of an event. With a test being conducted every ——— on the average, and with intervals between tests frequently varying for technical reasons, the number of tests in a given 12-month period normally fluctuates.

Question. These costs are apparently estimated by a field activity through use of computer modeling. Would you explain this estimating process? What supporting data is provided to DNA Headquarters in support of the estimate, and how is it validated?

Answer. A few years ago, the U.S. Army Waterways Experiment Station developed, for Field Command, DNA, an empirically-based estimating code for standard horizontal-line-of-sight underground nuclear tests. This code allows Field Command to specify a geometry within reasonable limits and quickly obtain a cost estimate. By making changes in configuration, Field Command can evaluate changes to test configurations. Development costs for this code were less than $100 thousand. This code provides Field Command with a rapid estimating technique and saves considerable labor hours which would be required to perform the estimate by hand. The code has been validated by comparing estimates with the actual cost of known events. Actual variance from code estimates are usually within ±10 percent. Detailed, updated event cost estimates are provided to Headquarters, DNA monthly and as required. These identify changes made to initial event estimates and reasons for the changes.

Question. Provide a breakdown of FY 1986 through FY 1988 budgeted funds for the UGT program by test event, and within test events by direct cost, indirect cost, instrumentation development, etc. Also state how much funding is budgeted for site upgrades, and explain why these are needed.

Answer. Underground Nuclear Test Budgeted Costs for FY 1987 are:

[CLERK'S NOTE.—FY 1988 budget costs have been deleted.]

[In millions of dollars]

Events	FY 1986	FY 1987
Mill Yard	0.1	
Diamond Beech	1.3	
Mighty Oak	5.1	
Middle Note	16.7	6.7
Mission Cyber	16.6	25.2
Mineral Quarry	17.0	16.0
Misty Echo		2.6
Distant Drum		16.0
Dido Shield		2.1
Diagonal Light		1.0
Disko Elm		
Huron Forest		
Total event direct costs	56.8	69.6
Indirect Costs		
Test instrumentation development	1.9	2.5
Site upgrades [1]	10.7	11.9
Test design and analysis	7.6	11.2
Other support cost [2]	13.1	16.2
Total indirect costs	33.3	41.8
Total UGT costs	90.1	111.4

[1] Site upgrade and real estate development funds support the development of new underground test areas as well as modernization of instrumentation and modernization of the various tunnel complexes. Mining times and development times are well in excess of a year. Currently, available test areas are critically short. Funds to develop new underground test areas are critically needed as the existing areas will have been fully expended after the execution of the next test, and the time required for mining into new underground real estate is in excess of a year.

[2] Other support includes costs for items such as operational support of Field Command test personnel, recording instrumentation, documentary photography, geological survey, engineering support, etc. This category of costs also includes site upgrade which includes performing alteration and improvements to test site equipment, instrumentation, buildings and other facilities, and for exploratory drilling/digging to explore geological areas for conducting events.

Question. When are the current estimated dates (months, days and years) for the following tests: MISSION CYBER, DIDO SHIELD, DIAGONAL LIGHT and DISKO ELM?

Answer. Current (not as reflected in the FY 1987 Budget) readiness period starts in month indicated:

Mission Cyber—September 1987.

DIDO Shield—Cancelled due to fiscal guidance reductions.

Diagonal Light—April 1991.

Disko Elm—September 1989.

NOTE.—Actual dates for execution are not established prior to completion of test bed construction, full testing of diagnostics and approval of test execution. The specific planned execution date for an event is classified until the event is announced. Therefore, for planning and budgeting purposes a readiness period by month and year is used; i.e., the test is planned and budgeted for completion of test bed construction and full testing of diagnostics during the month and year in which the readiness period starts. Although the dates indicated are nominal for planning and budgeting purposes, they are based on military system requirements, e.g., TRIDENT II may require testing in a specific time frame; hence, we establish a test to satisfy their requirement in a specific time frame.

REMOTE CLASSIFIED COMPUTING

Question. In September 1985, DNA advised the Committee of a change in its acquisition plan for the Remote Classified Computing project. Rather than procuring one prototype Top Secret work station and 16 full-up operational station, DNA plans to procure an unknown number of microprocessor work stations tied to a central Secret-level computer. Although contractors will procure the actual computers, DNA will procure supporting equipment and pay operational costs.

How many work stations does DNA plan to support in this program?

How was the requirement for a work station at each of these sites established? Was this requirement backed up by documented historic and projected workload data supplied by these contractors?

What is the estimated cost to the government for each of these work stations, both recurring and non-recurring?

The Committee is advised that, in its review of the FY 1987 budget, the Comptroller of the Office of the Secretary of Defense deleted funds for this project on the basis that DNA does not need to provide such relatively inexpensive equipment for its contractors.

Is this accurate?

Were these funds formally restored?

Provide a listing of the planned sites and a timetable for their establishment.

Provide the assumptions regarding workload growth which is reflected in the number of planning sites, and provide some historic data which substantiates those assumptions.

Answer. DNA does not plan to procure any microprocessor workstations or workstation-related computer equipment for remote classified computing. The September 23, 1985 report estimated that ten remote classified computing sites could be established in FY 1986. Currently, seven of these sites have been identified for FY 1986 installations; other sites have been identified as having potential requirements for remote classified computing. Further investigation of the classified computing requirements of these sites will be done before the three additional sites are chosen. Ten sites in all are the total presently being planned.

DNA will provide only the encryption equipment and the telecommunications equipment required for the first ten installations.

Non-recurring costs for each site are:	
Encryption equipment	$13,600
Telecommunications equipment	2,000
Recurring cost for each site:	
Encryption maintenance (per year)	1,200

———.

In summary, DNA will procure the encryption and telecommunications equipment for the ten sites already approved. ———.

[Clerk's note.—End of questions submitted by Mr. Chappell.]

ICBM SILO SURVIVABILITY

Mr. Chappell. Mr. Livingston has some questions he would like to answer for the record.

[Clerk's note.—Questions submitted by Mr. Livingston and the answers thereto follow:]

Question. Lieutenant General Pickitt, Doctor Atkins, last year Congress provided $15 million for an experimental effort related to ICBM silo survivability; specifically, these funds were to be used to construct, instrument and test a structure of double-walled cofferdam design. This Committee directed that a contract for such an effort be entered not later than March 1, 1986.

What is the status of the contract as it relates to DNA?

Answer. The Committee action referred to provide the $15 million to the Air Force for the contract in question. DNA is working with HQ, USAF and the Ballistic Missile Office on selected aspects of the subject work. This effort takes advantage of ongoing external shock mitigation work under way since 7 January 1985. DNA is to define and resolve nuclear effects issues related to large-scale test of external shock mitigation concepts. DNA contract actions must be complete by 30 April 1986 to meet direction. This contract lead time is consistent with current OSD practices.

Question. Has such contract been awarded?

Answer. The Air Force has been assigned the overall responsibility for this effort. DNA is generally aware of the overall status; however, we are not current on specifics of USAF contracting action awards.

Question. Why not?

Answer. This is an Air Force responsibility and it is our understanding that contractual actions are planned for FY 1987.

Question. The Committee intended, and still intends, that the structure in question be full-sized, not a scale model, and sized to be commensurate with the dimensions of a Minuteman silo. Is there any confusion on that point?

Answer. There is no confusion regarding your intent within DNA. There are, however, some practical limitations with which we have to deal. We have neither a blast simulator capable of producing the loadings that will probably be necessary nor an identified site that meets the geologic needs while also satisfying anticipated environmental constraints. Our work to date involved testing at a meaningful scale size. We continue to work with the Air Force to determine ways to overcome these limitations.

Question. What specifically are your plans for carrying out the project for which the funds are provided?

Answer. The DNA work defined above is intended to provide a base of information required by the USAF to properly design and assess the results of a large-scale ESM test.

Question. On what date will a contract for construction be awarded?

Answer. A fiscal year 1987 award is planned.

Question. Provide a detailed breakdown of RDT&E work conducted since FY 1983 on Missile Silo Hardening (for new and existing silos). This information should include:

a. Number of contracts awarded in this area each fiscal year
b. General description of these contracts and their purpose
c. Name of contractor involved
d. Cost of each contract

e. Agency or office within DoD or DoE responsible for each contract

Answer. A breakdown of DNA's RDT&E Fiscal Year 1984, Fiscal Year 1985, and Fiscal Year 1986 funded work directly related to the hardening of new and existing silos follows. Twelve contracts were funded each Fiscal Year. Data given below lists the contractor, the funding by Fiscal Year, and a description.

S-Cubed

Fiscal year:	*Amount*
1984	0
1985	$358,000
1986	0

Note.—Evaluate Shock isolation systems.

SRI International

Fiscal year:	*Amount*
1984	$492,000
1985	100,000
1986	250,000

Note.—Initiate a laboratory test program to investigate reinforced concrete behavior under high strain rates from dynamic loading.

Terra Tek, Inc

Fiscal year:	*Amount*
1984	$255,000
1985	444,000
1986	450,000

Note.—Initiate a laboratory program for reinforced concrete under intermediate strain rates.

Weidlinger Associates

Fiscal year:	*Amount*
1984	$445,000
1985	800,000
1986	800,000

Notes:
Develop advanced missile silo designs using blast shield technology.
Develop components for testing in field test programs.
Design a complete silo for testing in Demonstration of Principle test.
Develop advanced concrete material models for incorporation into three dimensional finite element calculations.
Refine advanced missile silo concepts.
Analyze the results of Demonstration of Principle and other tests.
Design additional silos and components for field tests.

Agbabian Associates

Fiscal year:	*Amount*
1984	$386,000
1985	600,000
1986	599,000

Notes:
Develop alternative advanced silo designs using external shock mitigation techniques.
Design components for field testing.
Design a complete silo for testing in demonstration of principle tests.
Further develop an alternative advanced silo design.
Interpret component Demonstration of Principle and other test results.
Design additional field test structures.

Aerospace Corporation

Fiscal years:	*Amount*
1984	$150,000
1985	150,000

1986	150,000

Notes:

Perform design calculations on structural dymamics to support the Agbabian design effort. Perform preshot predictions of test results.

ADVANCED CONCRETE MODELS

	Fiscal year—		
	1984	1985	1986
S-Cubed	$94,000	$100,000	$100,000
University of California, Berkeley	30,000	35,000	50,000
Gerwick Consulting Construction	30,000	60,000	0
Lawrence Livermore National Laboratories	44,000	30,000	50,000
Stanford University	26,000	25,000	103,000
Total	224,000	250,000	303,000

Note.—Team effort integrating the work of five contractors. Develop advanced theoretical models of concrete materials for incorporation into three dimensional finite element calculation.

Martin Marietta Corporation

Fiscal year:	*Amount*
1984	$500,000
1985	0
1986	1,122,000

Notes:

Initiate the design of new concepts for shock isolation systems.

Conduct parametric studies to establish design sensitivities to ground shock intensity and missile hardness.

Begin examining feasibility of designing scale models of shock isolation systems.

Develop advanced internal and external shock isolation systems.

Design model shock isolation system experiments for field testing.

Interpret results of scale model field tests.

Army Engineer Waterways Experiment Station

Fiscal year:	*Amount*
1984	$2,511,000
1985	1,686,000
1986	2,053,000

Notes:

Complete tests of components of innovative structural concepts.

Prepare complete silo designs based on component test data and analysis for testing in Demonstration of Principle tests and add-on experiments.

Conduct dynamic testing of candidate backpacking materials.

National Technical systems

Fiscal year:	*Amount*
1984	0
1985	$861,000
1986	81,000

Note.—Perform laboratory tests on shock isolation units.

[Clerk's note.—End of questions submitted by Mr. Livingston.

WEDNESDAY, APRIL 9, 1986.

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

WITNESS

DR. ROBERT C. DUNCAN, DIRECTOR

JAMES C. GOODWYN, DIRECTOR OF THE PROGRAM MANAGEMENT OFFICE

INTRODUCTORY REMARKS

Mr. **MURTHA** [presiding]. Welcome, Dr. Duncan, to the committee. We have a limited amount of time. We would appreciate it if you would provide your opening remarks for the record and summarize your comments.

Without objection, your entire statement will appear in the record.

OPENING STATEMENT OF DR. DUNCAN

Dr. **DUNCAN**. Yes, sir, Mr. Chairman. We have a statement to put into the record. I will try in just a few minutes to summarize the overall DARPA activities for you and try to answer whatever questions the committee has.

Mr. **MURTHA**. Proceed.

FRAMEWORK OF DARPA

Dr. **DUNCAN**. I will go through these fairly rapidly. I felt it would be well to set the framework of what DARPA does.

[Slide follows:]

CHARTER

- High-risk technology
- High military utility
- Long term
- Multi-service

BUDGET
($ in millions)

	FY 85	FY 86	FY 87
Research	74.8	93.5	108.4
Exploratory Dev.	361.1	453.1	480.7
Advanced Technology Dev.	173.7	177.2	232.6
Management and Support	31.5	16.1	16.2
	641.1	739.9	837.9

FY 86 PERSONNEL
(Authorized)

	MISSION	SUPPORT	TOTAL
Civilians	71	54	125
Military	23*	3	26
	94	57	151

*5 Army 5 Navy
12 AF 1 Marine

FY 86
AGENTS*

Air Force	21.7%
Navy	40.7%
Army	24.9%
Other DOD	7.2%
Non-DOD	5.5%

* By dollar volume

February 1986

295 10 24 83 19
R2 11 86

Dr. **Duncan**. The upper left-hand corner shows the charter of this organization. I consider it to be like a corporate research laboratory, to do advanced research, high-risk technology, with long-term potential and potential multi-service applications.

The right-hand corner shows the budget of DARPA. This does not include Gramm-Rudman reductions in any of the three columns, fiscal years 1985, 1986 or 1987.

The lower left-hand corner shows the personnel authorized in DARPA. It is a very small organization with a very large percentage of high-technology trained people, a large number of Ph.D.s, a mixture of civilian and military scientists and engineers.

The work is not done in DARPA laboratories; it is done in laboratories around the country—universities, in some cases, other government laboratories, and also in industry laboratories.

DARPA does not have its own contracting agency. We do all of our contracting through other organizations.

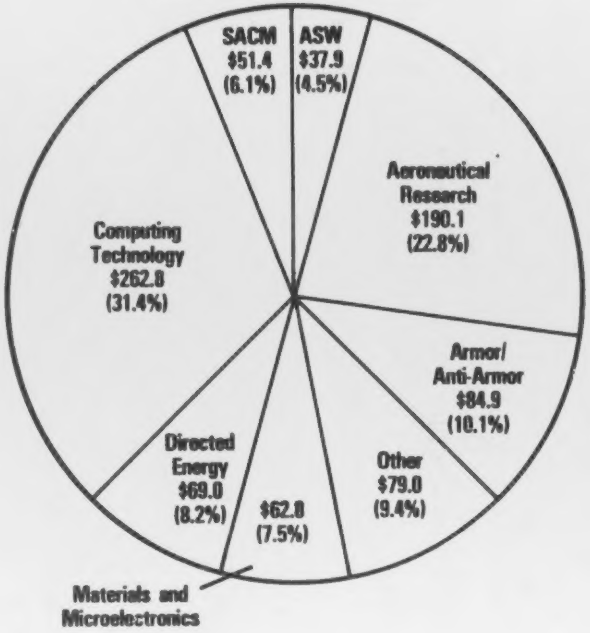
The lower right-hand corner shows the percentage by dollars by agents that do the contracting for us. About 95 percent of it is DoD agencies and actually 5½ percent non-DoD.

[Slide follows:]

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

FY 1987 Major Thrusts

Budget Request — $837.9 M
(dollars in millions)



255-2 11 86 18
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FY 1987 MAJOR THRUSTS

Dr. **Duncan**. The next slide shows—not in terms of budgetary line items but in terms of effort—how DARPA's 1987 budget would be spent. It shows, and this is the total budget of $838 million, by far and away the largest piece of the pie is computing technology at 31 percent; the next largest, aeronautical research is 23 percent. Strategic air and cruise missile defense is $51 million, for 6 percent. Anti-submarine warfare, 4½ percent. Directed energy, 8 percent. Materials and mircoelectronics, 7½ percent. Armor, anti-armor, 10 percent, and other things is 9 percent.

The other things include nuclear monitoring, small business, management headquarters support and new research areas that are not big enough to be included in this chart.

I would like to very quickly show one slide of each of these areas to give you a feeling for the total activities involved.

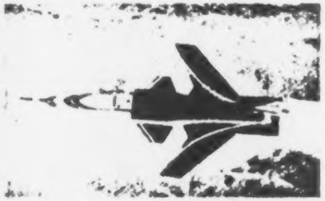
AERONAUTICAL PROGRAM

Starting with the aeronautical research programs—this does not represent all of them by any means—but it shows some of the major aeronautical research programs.

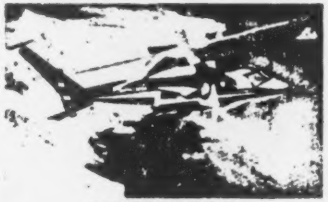
The X-29 advanced technology demonstrator has had 39 flights; it has flown at 40,000 feet, Mach 1.2 is the maximum speed so far achieved.

[Slide follows:]

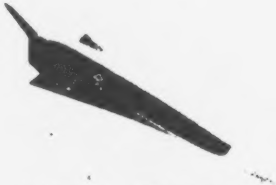
DARPA AERONAUTICAL PROGRAM



X-29 ADVANCED TECHNOLOGY DEMONSTRATOR



X-WING (RSRA)



NATIONAL AEROSPACE PLANE

PILOT'S ASSOCIATE

UNMANNED AUTONOMOUS VEHICLE

Dr. **Duncan**. The right-hand side shows the X wing, a cooperative program with NASA and the Navy and the Army. That aircraft will be flying this summer. That is a revolutionary new airplane that taken off like a helicopter, fixes its wings so it has forward and aft swept wings and can fly at high speeds.

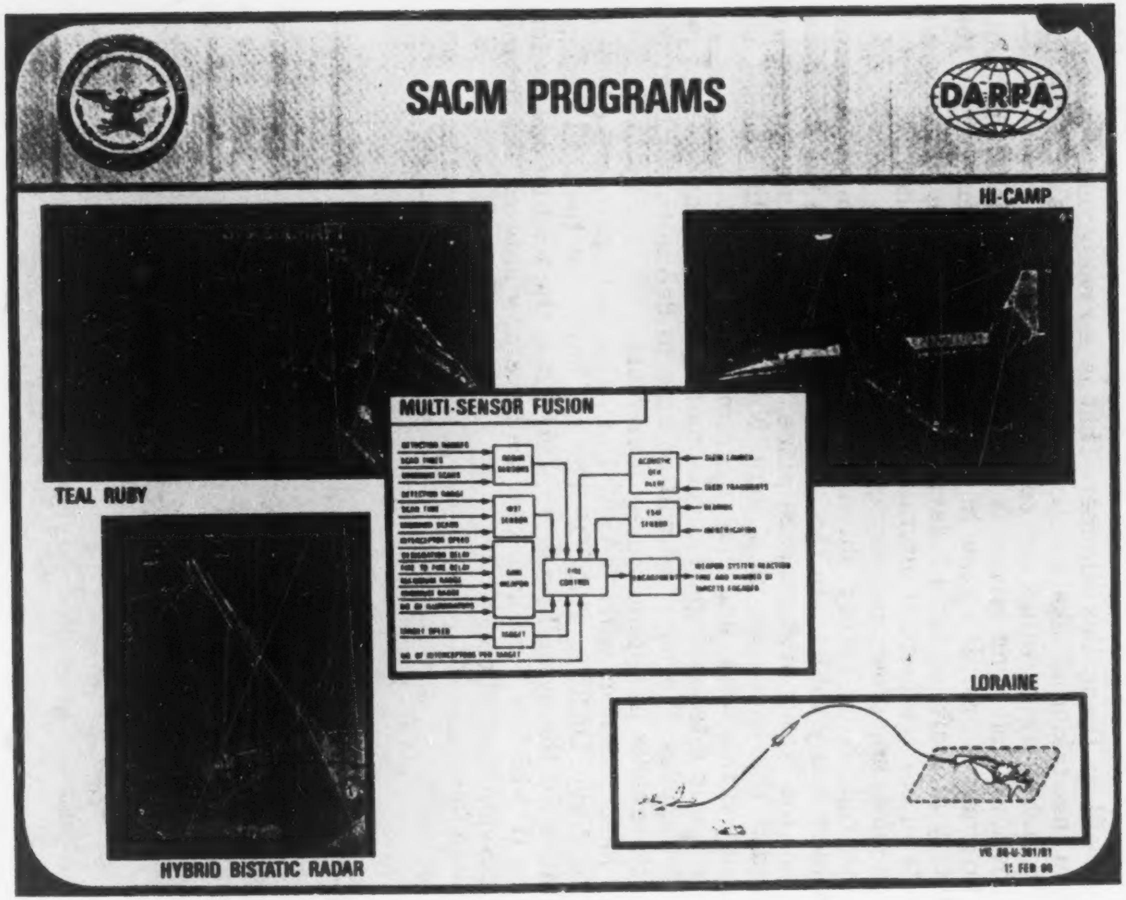
The lower left-hand corner is Pilot's Associate. This is a computer program to provide a crew to this pilot of a complex aircraft, the military aircraft we have today, and there will be spinoffs for air safety in our commercial aircraft because the loads that are placed upon pilots and crews are very great.

The right-hand corner shows unmanned autonomous vehicles. We have many vehicles in that arena. The middle is the one mentioned, the National Aerospace plane. In this particular area—we awarded the contracts in a joint NASA-DoD public release on Monday of this week, and that program is proceeding.

We are in a technological development phase leading to flight reserch vehicles. We hope we will be able to define these flight research vehicles in approximately four years.

A joint program with NASA, DoD, the DoD partners are Air Force, Navy, DARPA, and SDI. The Air Force has the lead responsibilities for the overall program. DARPA is the leading agency for phase II, which is the phase that we have now entered, the technical development phase.

[Slide follows:]



SACM PROGRAMS

DARPA
TEAL RUBY
HI-CAMP
MULTI-SENSOR FUSION
HYBRID BISTATIC RADAR
LORAINE

Dr. DUNCAN. The next slide summarizes our SACM programs, strategic air and cruise missile defense. Starting at the upper left, is the TEAL RUBY spacecraft, which has been in existence for quite some time. It is an infrared sensor system. It was to be flown off of the first military shuttle launched out of Vandenberg in July. We are on hold at this time.

The system is to go, it is under systems test. When we solve the problem of how to get a launch vehicle, we will be proceeding with the TEAL RUBY. It has been in DARPA as most of you know, for quite a long time. It is a prototype program, the type of program that the Packard Committee has recommended that DARPA do more of.

It presents a problem to us in the sense that when you get into a situation like we are at this time of waiting to find out when the launch is going to take place, it can drain resources away from other vital areas of our R&D programs—there is a large number of small programs with potentially high payoff. A program such as this gets to be a fairly large program because of the testing.

The upper right-hand corner is called HI-CAMP. It complements the TEAL RUBY. A number of flights have been made. This started in fiscal year 1981. Both programs involve coordinated activities with other countries, Canada, the U.K., and Australia. They are providing targets and we are getting signatures of tanks, ships and aircraft in a variety of situations against the earth background. We are particularly interested in low observable signals.

The lower left-hand corner shows the hybrid biostatic radar, a way of providing air defense of North America in the future.

Biostatic radar is one in which the sender and the receiver are in different bodies, different platforms. The illumination is provided by the spacecraft and the uplink comes to an aircraft.

The lower right-hand corner, a program called LORAINE, this is a non-nuclear long-range highly maneuverable vehicle that could be of great significance in the air delivered cruise missile environment of the future.

With this particular system, the vehicle could be launched from an aircraft or from the ground, either from a ship or other platforms, ———.

Our interest in this is the eyes of the system, which is a radar system. We have one very significant test that was conducted in concert with Sandia called a SWERVE test, which took place earlier, I think it was in April of 1985.

Mr. MURTHA. Let me interrupt you now. You have about 20 minutes, so you are going to have to make sure you get your points across. The things that you want to stress, make sure you get to those, because it looks like if you go through the program like this, it will take substantially longer.

SWERVE PROGRAM

Mr. DICKS. Will the Chairman yield?

I was just out to Sandia, and I saw the SWERVE program. I thought it looked promising. I was told out there that DARPA had cut out funding for it in fiscal year 1986.

Now, if it is such a great technology and it is so important to national security, why was DARPA eliminating funding for it?

Dr. DUNCAN. Can I back off just a moment to answer in the larger context?

Mr. DICKS. Sure.

Dr. DUNCAN. DARPA with the Gramm-Rudman reductions in 1986 and with the congressionally mandated reductions in their research and development funding took a total cut of 117 plus million dollars, 15 percent. Then with the Gramm-Rudman reductions of 1985, we added about six or seven more million to that.

I walked into DARPA four months ago, and suddenly was faced with about a 17 or 18 percent reduction in our total program, and we are 4/10 of the way into the year, so many commitments have been made, many memorandums of understanding or which there is another partner, like one of the miltary departments.

Mr. DICKS. Let me be sure I understand. The SWERVE warhead comes back in and then it cruises at about ——— miles an hour?

Dr. DUNCAN. ———?

Mr. DICKS. ———?

Dr. DUNCAN. It can zero in on the target——

Mr. DICKS. And maneuver to the target. You start thinking about this in terms of the ships and all kinds of targets, it seems to me it has enormous potential and that is why I was very surprised that you would pull out of the project.

Dr. DUNCAN. We are not pulling out of it. We were slipping the project into 1987 because of these enormous cuts. As a result of TEAL RUBY, of reevaluating the time delay in TEAL RUBY, we have now been able to get about $2.5 million to move into, and we are putting that into LORAINE for fiscal year 1986.

Mr. DICKS. I hope you will take another look at that program because I think it is a good one.

Dr. DUNCAN. It is going, sir.

Mr. DICKS. In the future it is going to go.

Dr. DUNCAN. $2.5 million this year we just reprogrammed because of the TEAL RUBY problem that we have been working on.

Mr. DICKS. I want to point out this to my colleagues, many of whom are very strong advocates of the President's strategic defense initiative. Because of the exemption that it was given, that is why DARPA had to take this 15 percent cut.

I think it is important to consider that with these other technologies we are trying to develop When you hold one program harmless, it means that other parts of the very important DARPA budget get cut more than any other part of the defense budget.

Dr. DUNCAN. That was my purpose in trying to give you a flavor for the wide scope of what DARPA was up to and the enormous impact that such cuts would have.

Mr. Chairman, I will show you only one other slide and then I will try to shortcut everything and let you aks me whatever questions that are appropriate.

[CLERK'S NOTE.—Classified slide removal.]

ANTI-SUBMARINE WARFARE PROGRAMS

One other I would like to show is the anti-submarine warfare programs, a similar slide. There is a whole variety of very important activities in that arena that we are involved in. Some of them are in concert with the Navy and some of them haven't reached that stage yet.

We feel that ASW is a very important aspect of our program, and have so indicated by having it as a major part of our investment.

The anti-armor I will skip. That is one that we have been pushing. It has been highly recommended that we put greater effort into it, and we are doing so. We are preparing to brief the Secretary of Defense on the program.

I would like to say we have a report on computing and I would like to give a copy to each member of the Committee. It describes in more detail than I could what we are doing.

This is the greatest thing that DARPA is doing because DARPA has led the way in making this country preeminent in the world in computing and we are threatened unless we continue aggressively in that field. It affects the defense posture and the entire economy of the country.

I think the investment that has been made through DARPA by way of Congress in the past, and I think I speak objectively because I have been in DARPA but for a short time, I believe it has led to a large entrepreneurial industrial base in PC's and other spinoffs which in turn feed back to help the defense posture of the country.

I will stop my presentation at this time.

[The statement and biography of Dr. Duncan follow:]

STATEMENT OF THE DIRECTOR, DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Overview

The FY 1987 budget request for the Defense Advanced Research Projects Agency will support the Agency's continuing role of advancing the frontiers of science and technology in areas vital to future defense needs. Investments in breakthrough research initiated in past years are yielding a sound technology base in several technical fields for exploitation by the Military Services. This statement supporting the Agency's FY 1987 budget request, will highlight some of the important achievements of DARPA research in FY 1986 and FY 1987. It will present the FY 1987 budget request and discuss changes from FY 1986, and it will provide notable examples of technology transition to the Military Services in FY 1986 and FY 1987.

In FY 1987 and outyears, breakthroughs in materials research will be offering low cost ceramics and ceramic composites to defense applications in armor, ceramic gun barrels, gas turbine engines and radar absorbing structures. Other materials research is expected to provide options for new space structures with zero coefficient of thermal expansion and no thermal hysteresis in the temperature range of -160°F to 250°F. Research on new coating materials is expected to extend the lifetime of carbon-carbon components in high-temperature gas turbine engine applications. Electronic materials research is yielding a new permeable base transistor capable of operating at frequencies in excess of 100 gigahertz. These transistors may have the fastest switching speed of any transistor yet fabricated, on the order of a few picoseconds.

These are but a small sample of the advanced research yields at DARPA. Much of this basic and applied research base will be extended and applied in the next few years to the new DoD/NASA National Aerospace Plane program.

Other applications will be available to Military Services for armored vehicle development, anti-armor penetrators, advanced fighter aircraft, advanced cruise missiles, smart weapons, low observable vehicles, ASW, surveillance, battle management, nuclear test monitoring, tactical directed energy weapons, hypervelocity guns and many more.

The Agency's budget request for FY 1987, reflects a 8.8% real growth over the FY 1986 level. Much of this growth is attributable to the new National Aerospace Plane, and new initiatives in armor/anti-armor.

This statement will highlight some of the accomplishments and new initiatives in FY 1986 and FY 1987. It will present the breakout of the FY 1987 budget request by budget activity, discuss budget trends and program source of changes. Finally, transfers of technology to the Services in FY 1986 and FY 1987 will be presented.

II. FY1986/FY 1987 Program/Technology Highlights

A major highlight of DARPA's FY 1986/FY1987 activities is the National Aerospace Plane technology program. This is a joint DoD/NASA research program which could lead to an entirely new family of aerospace vehicles. Conceptually, a future Aerospace Plane would be able to operate as an airplane at hypersonic velocities (4000 to 8000 miles per hour) in the upper atmosphere, or as a space launch vehicle capable of accelerating directly into orbit. The DoD/NASA program unifies hypersonic research which has been ongoing for several years. Recent research in hypersonic propulsion, advanced materials and structures, and computational fluid dynamics has contributed to a consensus that an Aerospace Plane may someday be possible. The Aerospace Plane concept was defined during 1982-1985 in a concept exploration effort by DARPA and NASA with widespread participation by industry and other government research centers. The concept centers on a hydrogen-powered aircraft capable of horizontal take-off and landing, and capable of operating at speeds between Mach 12 and Mach 25 at altitudes between 100,000 and 350,000 feet. The technology development phase, underway in 1986, will address the maturation of many technologies, propulsion module development, and airframe design of an experimental flight research vehicle. Participants in this phase include Air Force, Navy, DARPA, SDIO, and NASA. There is an 80%/20% funding split between DoD and NASA.

Potential Aerospace Plane capabilities of national interest include global flight, long-range air defense interceptor, significantly reduced payload to orbit transportation costs, and dramatically reduced transit times on long haul airplane routes with corresponding economic benefit.

The Strategic Computing project is advancing the state-of-the-art in machine intelligence, machine architectures and microelectronics. Machine intelligence efforts are underway in computer vision, speech, natural language and expert systems. A new-generation vision system demonstrated outdoor dynamic image processing 400 times faster than any previous system. A speaker independent continuous speech recognition system with a 200-word vocabulary was demonstrated for the first time. An initial version of the natural language understanding system, IRUS, is being demonstrated at CINCPACFLT. The system understands 2000 words and 700 Naval related concepts. In the multiprocessor system architecture areas, a 10-cell 100 MFlop WARP programmable systolic array system was developed, demonstrated, and is in production. A faster, more compact VLSI version is being designed. A 64 thousand processor Connection Machine has been completed and demonstrated. In fluid dynamics calculations it is a factor of four faster than a Cray-X/MP at 1/6 the cost. In document query over a 10 gigabyte database it is five times faster than a Cray X/MP and completes a search in 3 minutes that takes the large IBM mainframe currently used for this task 6 hours. In image processing, it is equivalent to 1000 to 10,000 of the VAX 11/785's currently used in many systems. This performance promises dramatic breakthroughs on many DoD imagery analysis problems. A 256 processor Butterfly Architecture has been demonstrated and performance found to scale linearly for a large number of important problems. The Butterfly processor is now in commercial production. In microelectronics, optical links for board-to-board interconnection of the 64 thousand processor Connection Machine and the WARP programmable systolic array are being investigated.

Applications of the Strategic Computing technologies are proceeding for the Autonomous Land Vehicle (ALV), the Fleet Command Center Battle Management project (FCCBMP), Airland Battle Management (ALBM), the Pilot's Associate project, and a system for Radar/Optical Imagery Analysis. In FY 1986, the Autonomous Land Vehicle demonstrated speeds up to 20 kmph over a road containing fixed obstacles. In FY 1987, it will demonstrate autonomous, cross-country, navigation over rough terrain with speeds up to 10 kilometers per hour. The real significance of these demonstrations is in showing how to integrate, in real-time, dynamic vision, expert reasoning and numerical calculations; a requirement for achieving "brilliant" weapons systems. The Naval Fleet Command Center Battle Management testbed has been installed at CINCPACFLT headquarters and a fleet readiness evaluation aid demonstrated which provides a factor of three performance gain over unaided performance. An integrated speech/natural language interface to this aid will be installed and evaluated in FY 1987. Four demonstration expert systems have been developed in the Pilot's Associate project. These will be substantially expanded and linked together in FY 1987 and beyond. A force-on-force Corps level combat simulation was benchmarked on the Butterfly multi-processor for the ALBM project. Results show a factor of 20 to 50 improvement in execution time is possible permitting 10 hours of combat to be simulated in 4-12 minutes. Further research on ALBM will demonstrate cooperative maneuver planning between Corps and Division headquarters.

The Submarine Laser Communications project is developing the technology necessary for providing critical underwater communications using blue-green lasers. DARPA is continuing the design and fabrication of the space-qualifiable Laboratory Transmitter Module (LTM). Life testing of a laser device using the same xenon chloride, Raman-shifted technology as LTM has started. Reliability and degradation data over more than a billion pulses is being taken and applied to the LTM project. Solid state laser research for this project is underway at Lawrence Livermore National Laboratory. The LTM will be tested over 200 million pulses. Design and test data on both the LTM and the atomic resonance filter receiver will be evaluated by the Navy for possible system development and operational use.

Joint use of the charged particle beam Advanced Test Accelerator (ATA) at Lawrence Livermore National Laboratory is being made by DARPA and the Strategic Defense Initiative Organization in FY 1986. DARPA has conducted propagation experiments in full density air with remarkable results. Beam pulses which have been properly prepared have shown stable propagation in open air. The specific limits on the effectiveness of beam conditioning will be studied during the remainder of this fiscal year. The goal for FY 1987 activities is to obtain firm evidence for the feasibility of multiple pulse schemes to maximize the range and efficiency of beam propagation. It is important to note that the Advanced Test Accelerator and the entire particle beam technology base developed by DARPA will form the core of the new Free Electron Laser Program initiated by SDIO.

DARPA is accelerating its armor/anti-armor research efforts in FY 1986 and FY 1987 under strong recommendation by the Defense Science Board (DSB). The DSB findings show that the competition in armor/anti-armor now is in favor of the Soviet Union, and is continuing to increase in their favor. DARPA proposes to extend its research base in kinetic energy weapons, lightweight composite armor, platform and system integration.

There are many more elements of the DARPA advanced research programs. This report only presents those effort which have been of interest to Congress in the past, and a few exciting new initiatives.

III. The FY 1987 Budget Request

The DARPA FY 1987 budget request is $837.9 million, a real growth of 8.8% over the FY 1986 level. The current FY 1986 budget level of $739.9 million resulted when DARPA sustained a $47.5 million allocation of the Congressional-directed undistributed Defense Agencies budget reduction. This FY 1986 budget does not reflect potential Gramm-Rudman-Hollings reductions. The breakdown of this request by Budget Activity and R&D category, along with the two prior year appropriations, is as follows:

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH AND DEVELOPMENT APPROPRIATIONS AND
BUDGET REQUEST ($ in thousands)

	APPROPRIATIONS		BUDGET REQUEST
	FY 1985	FY 1986	FY 1987
BUDGET ACTIVITY 1			
6.1 Research	74,807	93,480	108,400
6.2 Exploratory Development	361,080	453,110	480,680
BUDGET ACTIVITY 2			
6.3 Advanced Development	173,692	177,179	232,600
BUDGET ACTIVITY 6			
6.5 Defensewide Mission Support	31,552	16,148	16,200
TOTAL	641,131	739,917	837,880

The proposed FY 1987 investment for research (6.1) of $108.4 million reflects a $14.9 million increase over the FY 1987 appropriations. Over $6 million of this increase is for the DARPA's University Research Initiative. DARPA's request in FY 1986 was $6.25 million and in FY 1987, $12.5 million. The Congress added $75 million to OSD to supplement the combined DARPA, Army, Navy, Air Force FY 1986 request of $25 million. The OSD is administering these funds, but DARPA expects to receive its proportionate share. A second major source of 6.1 increase is in the Electronic Sciences Project. Here, research in superlattices is being expanded. The developments of molecular beam epitaxy (MBE) and metal-organic chemical vapor deposition (MO-CVD) systems have opened up a totally novel concept for semiconductor technologies-materials engineering. Artificially created superlattices can, in principle, be tailored to yield pre-determined bandstructures selected to optimize device performance. Research in low-cost ceramics and ceramic composites, previously mentioned in Section I, also contribute to this increase. Overall, the DARPA applied research program is a major national asset, generating major research breakthroughs being exploited now and in the future for DoD, other government interests and the private sector.

The proposed 6.2 exploratory development budget request of $480.7 million reflects a $27.5 million increase over the FY 1986 appropriation. The major part of this increase is in the Tactical Technology Program Element. In this area, DARPA is exploiting a major breakthrough in devices for wideband signal processing. The research program is called Acoustic Charge Transport (ACT). It is a hybrid analog/digital device technology which makes possible small, low-cost, low power microelectronic components for large dynamic range, large processing gain, extremely wide bandwidth, radiation hard, radar and communication signal processing systems. Representative signal processing units will be designed, fabricated and tested in FY 1987. Research in the previously mentioned new armor/anti-armor initiative also contribute to the increase in Tactical Technology.

The DARPA Dual Alloy Radial Turbine (DART) research is moving into the demonstration phase. This is a gas turbine testbed of novel design (dual entry compressor, second stage compressor) which will ultimately allow testing of advanced composite materials and structures at extremely high temperatures (3500°F) and pressure ratios (25:1) in the turbine section.

Also included in the 6.2 Exploratory Development request are funds for the Nuclear Monitoring Research program. This program is providing the research base in support of the U.S. capability for monitoring nuclear test ban treaties. A prototype seismic array was installed in Norway in FY 1985 which takes advantage of seismic signals propagating along low-loss paths from the Soviet Union. An order of magnitude improvement in signal detection is expected from this advanced array for signals originating in the western part of the Soviet Union. Two advanced methods for yield estimation have been developed which are far superior in accuracy and precision to current means. DARPA is continuing its support to the Center for Seismic Studies which collects and analyzes event data from U.S. stations. Other highlights supporting the 6.2 budget request were presented in Section II.

The DARPA budget request for Advanced Development (6.3) is $232.6 million, a $55.4 million increase over the FY 1986 appropriation. The major program contributing to this increase is the National Aerospace Plane. The technology base effort is funded in Budget Activity 1 in FY 1986. Hence, the full request for FY 1987, $60 million appears, for the first time in Advanced Development (6.3) in FY 1987. The importance of this program was discussed in Section II and its priority is among the nation's highest in R&D. An additional increase in 6.3 is for a classified program.

These increases are offset, to some degree, by decreased funding in several programs undergoing transition out of DARPA. Among these are the X-29 Advanced Technology Demonstrator, the X-Wing/RSRA project, and the Teal Ruby project. The first two will be discussed in the next section.

The Teal Ruby space-based experiment will be the first large-scale implementation of a two-dimensional staring mosaic infrared detector array and lightweight telescope optics to be launched into space by the NASA shuttle. Its goal is to establish the technology for future space-based infrared surveillance systems capable of detecting aircraft and other low threshold targets against the earth's clutter background. It will develop a comprehensive radiometric background database, and space qualify the advanced technologies embodied in its design. It is expected to be under test in FY 1987.

The Defensewide Mission Support remains essentially at its FY 1986 level. This Activity supports the Agency Headquarters staff, office space and equipment, and field military procurement agents who handle DARPA's contracting.

IV. Technology Transition

The measure of success of DARPA's investment in research and development is the eventual use of its R&D products in some form by the Military Services. Recognition of this transition of technology may not be readily apparent in many of the military hardware programs which benefit from its infusion. Research breakthroughs may occur at the idea stage where revolutionary approaches to current mission strategies lead to greatly enhanced mission performance. The use of clustered smart weapons in an anti-armor role is a typical example. The ideas may challenge the military roles and missions such that it forces a re-thinking of the battlefield strategy. Conversely, the idea may languish until elements of feasibility are demonstrated. Breakthroughs at component or subsystem level such as autonomous sensors and homing may be essential to acceptance of the revolutionary idea. A typical example of this pathway to technology transition was the DARPA Assault Breaker program. Out of this DARPA research and development demonstration was evolved the Air Force JSTARS and the Army JTACMS programs.

Another approach to technology transition may be in the form of applied research or component development breakthroughs. A typical example is DARPA's materials research program leading to rapid solidification in formation of super alloys now finding application across the Services.

A third mode of technology transition is through the university and industrial base. Much of the research support by DARPA in the universities and industrial sector finds its way into military systems when it becomes an integral part of an industrial bid on a military system. One might call this the invisible transition, as the connection to the basic DARPA supported research is usually obscured.

Some of the more prominent and viable technology transitions in FY 1986 and FY 1987 are documented here.

X-29 Advanced Technology Demonstrator: This technology is a feasibility demonstration project for advanced aerodynamics, structures and flight controls for future generation tactical aircraft. Research in advanced composite materials, computer aided design, advanced aerodynamic and structural analytical design methods, and digital flight controls is embodied in a highly instrumented experimental research aircraft which has been in flight test by DARPA, NASA, and the Air Force over the past year. Aircraft performance has exceeded predictions and the aircraft has been extremely reliable and safe. Tests were conducted by an integrated team of NASA, Air

Force, and Grumman test pilots and maintenance crews. Flight test results are already being used throughout industry.

These tests are being expanded in FY 1986 and FY 1987. The FY 1987 budget request will be augmented by the Air Force and NASA to support continuation of testing and transition of the program to the Air Force in FY 1987.

X-Wing/RSRA: This project addresses technology demonstration for a vertical takeoff and landing aircraft which, by stopping the rotor in flight, combines the vertical lift efficiency of a helicopter with the speed, range, and altitude performance of a transonic fixed wing aircraft. Design analysis indicates that an operational X-Wing vehicle would have approximately three times the speed, range, and altitude performance of a conventional helicopter with equivalent payload lifting capability. These characteristics enable a very broad operational applicability such as: more flexible sea-basing for the Navy for conducting long range anti-submarine warfare; over-the-horizon targeting of surface and air targets; tactical jamming; close air support; and intra-theater self deployment capability. This demonstration project is being managed and funded in accordance with a FY 1983 DARPA/NASA agreement and utilizes the NASA Rotor System Research Aircraft (RSRA). The large (56-foot diameter) rotor, fabricated of graphite composites has been installed on the RSRA and the vehicle is being tied down for initial integration system tests. Initial flight test by the contractor will commence in mid FY 1986, and continue throughout the year. After review of flight test results and demonstration of feasibility and practicability in FY 1987, the project will be transferred to NASA for completion of experimental testing. Flights during FY 1987 will include conversion from rotary wing to fixed wing (and reverse) with higher harmonic adaptive vibration controls.

Submarine Laser Communications: Transition of this technology to the Navy is underway in FY 1986 and is expected to be completed in FY 1987. DARPA is continuing fabrication and test of the space-qualifiable Laboratory Transmitter Module (LTM). The LTM will be tested to over 200 million pulses. An effort to explore the potential improvements to the baseline system using solid state lasers is continuing. All data from these DARPA efforts will be made available to the Navy for decision on full scale SLC development.

ARIADNE: This program, sponsored under the Naval Warfare Project of the Tactical Program Element 62702E has extended the technology of fiber optics to strategic or tactical undersea surveillance. Low-loss, wet-mateable, single-mode fiber-optic connectors have been developed and tested under 10,000 psi sea water at losses consistently less than ½ db. Lightweight, single-mode undersea, fiber-optic cables were developed and tested, and test sections are being produced in several kilometer lengths at $1.79 per meter. Repeater/Multiplexer/Connector prototypes are in final stages of fabrication. Multiple mechanical models of the successful node design, connected by fiber-optic cables, are being used to perform at-sea rehearsals of ARIADNE string deployment. In FY 1986, prototype hardware will be integrated and tested at-sea as an initial small-scale ARIADNE system. With completion of the sea tests the technology will be transferred to the Navy.

Advanced Conformal Submarine Acoustic Sonar (ACSAS): Under this program DARPA together with the Navy is conducting research on a new high gain submarine sonar to be designed as part of the ship's hull. This conformal hull array will provide two dimensional direction finding, and will allow for detection at speeds higher than achievable with current systems. Small scale array structures have been built and tested, as well as several variants of the basic hydrophone. A ¼ scale system model is being fabricated and will undergo testing in FY 1987. Transfer to the Navy will be accomplished at the end of FY 1988.

AMBER: This is an unmanned low cost aerial vehicle technology development to demonstrate long endurance capabilities. The test vehicle is approximately 600 pounds gross weight and achieves its long endurance through utilization of advanced composite structures, an advanced lightweight, low-fuel-flow engine, and "sail plane-like" aerodynamics. Existing Service payloads will be integrated into AMBER along with data links and ground stations. These systems will be tested to determine the operational utility for the Navy, Marines and Army.

The Amber technology will transition to the Army and Navy in FY 1987.

Many smaller research activities are yielding spin-offs into Service applications. Some of these important contributions to the military R&D posture were discussed in Section II. Further, DARPA has several research programs which are jointly funded by DARPA and one or more of the military Services. This process leads to early technology transition.

V. Summary

The DARPA research and development program continues to be a highly leveraged investment. In addition to the above discussed technology transitions, DARPA's research in high energy lasers, particle beam accelerators, space surveillance, hypervelocity weapons, precision acquisition and tracking, short wavelength lasers, laser damage assessment, and electromagnetic propulsion research laid the foundation for much of the research continued under the Strategic Defense Initiative Organization. DARPA accepts its charge by the Secretary of Defense to advance the frontiers of science and technology for U.S. military advantage over potential adversaries. Its efforts are devoted to searching out the bold and imaginative new research ideas and providing adequate support to foster these ideas through to realistic demonstrations of sound technology. The continued support of Congress is essential to the success of this mission.

BIOGRAPHICAL INFORMATION

ROBERT CLIFTON DUNCAN

Dr. Robert C. Duncan joined the Defense Advanced Research Projects Agency on November 18, 1985 as their Director; chief executive officer of an independent Defense agency responsible for research and exploratory developmental concepts that are not yet identifiable with a specific military requirement of Service mission, or which relate to the function of more than one Military Service. Provides technical direction and establishes management policy for an agency of about 145 people conducting R&D projects totalling more than $700 million per year.

Dr. Robert C. Duncan joined the Polaroid Corporation, Cambridge, Massachusetts, in 1968 and was elected a corporate officer and named Assistant Vice President in 1969. In 1975 he was elected Vice President, Engineering. From 1968 to 1975 he had the additional duty as Program Manager for the SX-70 camera and film systems.

Dr. Duncan was Assistant Director, NASA Electronics Research Center, Cambridge, Massachusetts, in 1967 and 1968. He served from 1964 to 1967 as Chief of the Guidance and Control Division at NASA's Manned Spacecraft Center, Houston, Texas. In this capacity, he was responsible for developing the guidance and control system for the Apollo spacecraft used in the lunar mission (command module and lunar module). He was Special Assistant to the Director of Defense Research and Engineering in the Office of the Secretary of Defense from 1961 to 1963. He served in 1960 and 1961 as Chief, Space Programs Branch in the Office of Chief of Naval Operations. Previously he had served operational tours in three Navy squadrons as a pilot of fighter and attack aircraft. Prior to Navy flight training in 1947, he served two years aboard the U.S.S. Bremerton (CA-130) in the Pacific and was stationed in China and Japan.

Dr. Duncan graduated with a Bachelor of Science degree from the U.S. Naval Academy in 1945. He holds a Bachelor of Science degree in aeronautical engineering from the U.S. Navy Postgraduate School, a Master of Science and a Doctor of Science degree in aeronautical engineering from the Massachusetts Institute of Technology. He is the author of one book, "Dynamics of Atmospheric Entry" (McGraw-Hill, 1962), co-author of three other books, and has published more than three dozen technical papers.

In 1964, Dr. Duncan was awarded the Legion of Merit for outstanding contributions in the field of inertial guidance and control. He was awarded the 1967 Norman P. Hays Award from the Institute of Navigation. He was awarded the NASA Exceptional Service Medal in 1968. He was elected to the National Academy of Engineering in 1981. He is a Trustee Emeritus of the Forsyth Dental Center (Boston), former Member of the Industrial and Professional Advisory Council of Penn State University, Member of the Executive Board, Norumbega Council, Boy Scouts of America, and a former Member of the Board of Directors of the Charles Stark Draper Laboratory. He was awarded the Silver Beaver (1977) and the Distinguished Eagle Scout Award (1984) by the Boy Scouts of America.

Born in Jonesville, Virginia, November 21, 1923, Dr. Duncan is married to the former Rosemary Fleming of Pensacola, Florida. They have four children: Mrs. Melissa Keeney, Mrs. Babette Wilson, Robert and Scott.

Mr. MURTHA. The gentleman from Washington.

ADVANCED CONFORMAL SUBMARINE ACOUSTICS SONAR (ACSAS)

Mr. DICKS. Thank you, Mr. Chairman.

Can you tell us a little more detail about your advanced conformal submarine acoustics sonar (ACSAS) program?

Dr. DUNCAN. Yes. We are working with the Navy on this particular system as the Navy's the full-fledged partner in this. It is the first effort at designing a submarine and its sonar system as an integral system. The current sonar systems are towed systems. In ACSAS, the sonar is an integral part of the hull of the submarine. It gives an improved performance factor in terms of range and sensitivity by at least a factor on ten.

This is far beyond the talking about or laboratory stage. We do have a one-fourth scale, 50-ton model that is being put together. It will be launched during the next fiscal year. It is a joint DARPA-Navy program. We will be actually testing the problems and performance of such a system.

The Navy expects to have an initiative in their 6.3 budget by fiscal year 1989, assuming all goes well and it meets our expectations, of incorporating this into their submarine design activities.

Mr. DICKS. I am told that funding for this program is planned to decrease from $17.5 million in 1985 to $10.9 million in 1987, and very little funding is programmed for the outyears.

Are you saying that the Navy will pick up funding for this particular program?

Dr. DUNCAN. The Navy is already involved, yes.

It has slipped, the program has slipped with respect to Navy funding and with respect to total funding by approximately a year. The original program, it is my understanding, was potentially tied in with SSN-21 decisions with respect to design.

The time table of the program is such that it will influence follow-on submarine systems.

Mr. DICKS. You mean the next submarine after the 21?

Dr. DUNCAN. It would be the next submarine systems after the 21; later models.

Mr. DICKS. Why did the Navy abandon the time table of trying to mesh these two? If it gives that improvement in sonar, why wouldn't they incorporate it sooner?

Dr. DUNCAN. Well, I would have to try to provide an answer for the record on that because I don't believe I can give you the Navy's answer to that.

Mr. DICKS. What is your answer to it? They just didn't line it up in time, just a timing issue or was it lack of DARPA funding?

Dr. DUNCAN. It is a——

Mr. DICKS. Lack of funding in 1986 and 1987 for DARPA. You say it delayed it a year. Is that what made it impossible to put the two schedules together?

Dr. DUNCAN. I would have to—I don't think I——

Mr. DICKS. It certainly didn't help.

Dr. DUNCAN. It didn't help, but I don't believe funding has been the key to slippage. I think other things have, technologically related things, but, Mr. Dicks, I prefer to give you an accurate answer in the record rather than speculate.

Mr. DICKS. All right.

[The information follows:]

Dr. DUNCAN. ACSAS has begun independent of, and prior to, the start of the SSN-21 project. The impetus behind ACSAS was the recognition by the Navy, where the project was born, that very much larger sonar arrays are needed, and ACSAS' objective was to find out how to do that. The answer had been established in broad principle by the time the SSN-21 work began; ———.

ARMOR/ANTI-ARMOR

Mr. DICKS. Would you tell us a little about the armor/anti-armor program?

Dr. DUNCAN. Well, the Defense Science Board study of this past summer determined that this was ———.

The Secretary of Defense has directed us, working with the Army and Marines, to put a major new initiative in our R&D programs to help resolve this.

Now, it is a larger. It involves penetration physics and armor protection systems. It involves component technology. We are expanding it beyond that to include other factors related to tank design that I am not free to discuss.

Mr. DICKS. Why aren't you free to discuss it?

Dr. DUNCAN. From a classification standpoint.

Mr. DICKS. In this particular hearing?

Dr. DUNCAN. Yes, sir.

Mr. EFFORD. This is classified top secret.

Dr. DUNCAN. It is a black program.

Mr. EFFORD. All right.

Dr. DUNCAN. Working with the Army and Marines, we have a program that we have briefed through the Secretary of the Army and are prepared to take to the Secretary of Defense. The DARPA program would involve a heavy fiscal year 1986 investment as well as a heavy fiscal year 1987 investment. In 1986, we are talking about $44 million; 1987 would be $85 million essentially.

Mr. DICKS. Thank you, Mr. Chairman.

Mr. MURTHA. The gentleman from Ohio.

Mr. MILLER. No questions at this time, Mr. Chairman.

IMPACT OF SPACE SHUTTLE DISASTER ON TEAL RUBY

Mr. MURTHA. Let me ask you about a couple programs here. The impact of the space shuttle disaster on the TEAL RUBY program. That program involves determining the feasibility of a space-based infrared sensor to detect strategic bombers and cruise missiles. TEAL RUBY was to be launched from the space shuttle in 1986. What schedule impact did the space shuttle disaster have on the TEAL RUBY?

Dr. DUNCAN. It has an impact, but we have not determined it yet. We have not resolved what launch vehicle TEAL RUBY will go on.

Mr. MURTHA. What degree of funding was appropriated in 1986 and is budgeted for fiscal year 1987 for direct support of this launch?

Dr. DUNCAN. I don't have the 1986 level.

Mr. MURTHA. Provide that for the record.

[The information follows:]

A total of $25 million was appropriated in FY 1986 and $10 million is included in the FY 1987 budget to support a TEAL RUBY shuttle launch. It is now anticipated that the shuttle launch will be delayed at least one year which impacts the FY 1987 budget request by requiring a revised total of $19 million.

Mr. MURTHA. Does DARPA anticipate a revised funding profile for TEAL RUBY with less near-term funding greater out-year funding?

Dr. DUNCAN. We have less near-term and greater out-year funding, yes.

NUCLEAR MONITORING

Mr. MURTHA. DARPA's nuclear monitoring program was also affected by the Challenger disaster. Two experiments of new monitoring methods were to take place in fiscal year 1986 from the space shuttle.

What was the schedule impact on this program?

Dr. DUNCAN. I would have to say that we have not determined yet how we are going to resolve that schedule. You are absolutely correct; there were two additional experiments over and above TEAL RUBY that we were involved with on that particular spacecraft.

Mr. MURTHA. What degree of funding was planned in fiscal year 1986 and fiscal year 1987 for direct support of this launch?

Dr. DUNCAN. I don't have the 1986 numbers, sir. I will have to provide it for the record.

[The information follows:]

A total of $1,695 thousand was planned in FY 1986 and $655 thousand in FY 1987 for direct support of this launch. If the launch occurs in September to November 1987, an additional $588 thousand is required for the FY 1987 budget.

Mr. MURTHA. Is a revised funding profile expected for this program?

Dr. DUNCAN. Yes.

Mr. GOODWYN. Much less impact than TEAL RUBY.

Dr. DUNCAN. It is much smaller—TEAL RUBY is a big program and this is much smaller.

Mr. EFFORD. Dr. Duncan, is TEAL RUBY too large to be sent up into space by means other than the space shuttle?

Dr. DUNCAN. There are complications with respect to that. I can't say that there is no non-manned launch vehicle that can do it, but I am not aware of a solution yet, other than the shuttle.

NATIONAL AEROSPACE PLANE

Mr. MURTHA. Let's talk about the national aerospace plane.

Provide a basic description of what the NASP program involves, including its anticipated mission role and the need for an accelerated development effort.

Dr. DUNCAN. I gave a briefing, sir, to the NASA Committee this morning and I would like to use three slides I had in that briefing to answer your question, if I could.

We have the model, too.

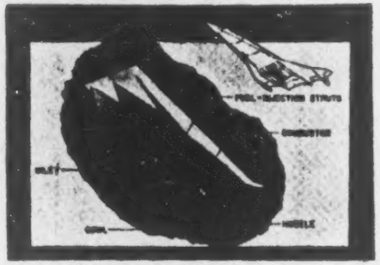
Mr. **Murtha**. Beautiful.

Dr. **Duncan**. The national aerospace plane has been under study in DARPA in what is now called Phase I since 1982. The decision was made in 1985 that there was a confluence of technologies that made it possible for this country to commit itself to such a vehicle. This is not only our judgment, but it is the judgment of many groups of experts that we have taken it to, the various partners participating in it of which there are 5—NASA, DARPA, Air Force, Navy, and SDI.

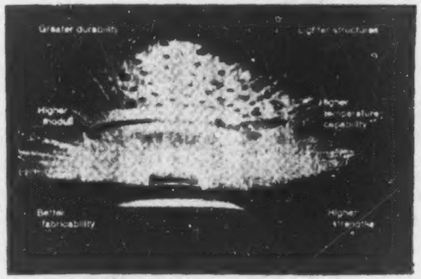
[Slide follows:]

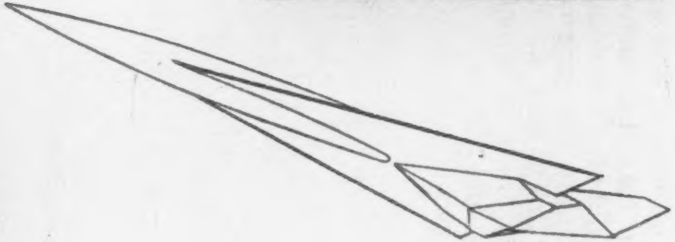
KEY AERO-SPACE PLANE TECHNOLOGIES

AIRBREATHING PROPULSION


FUEL-INJECTION STRUTS
COMBUSTOR
INLET
COWL
NOZZLE

LONG LIFE MATERIALS


Greater durability
Lighter structures
Higher moduli
Higher temperature capability
Better fabricability
Higher strengths



COMPUTATIONAL AERODYNAMICS

Dr. **Duncan**. The primary leading technologies are shown on this chart: air breathing propulsion, development of long life-type high temperature-resistant materials, and computational aerodynamics. Computation aerodynamics is not a trivial issue because in this particular one it is an air breathing vehicle; it is an integrated propulsion air frame in that the forward part of the vehicle serves as a compressor stage for the engine. The engine is located there and after the gas is exhausted, the air frame is part of the——

Mr. **Miller**. Could I interrupt?

Mr. **Dicks**. Yes. Go right ahead.

Mr. **Miller**. We had a model of that plane this afternoon, a smaller model. We see the exhaust. It is an air breathing plane.

Dr. **Duncan**. Yes, sir.

Mr. **Miller**. But I do not see the inlets for the air on the other model or that one.

Dr. **Duncan**. The inlets—this is just a brief mock-up of it, but the actual inlets are right through here.

Mr. **Miller**. I see. Very good.

Dr. **Duncan**. The reason this vehicle has such great weight-carrying potential when compared to the shuttle is that it takes its oxygen out of the atmosphere. It doesn't carry liquid oxygen.

Mr. **Miller**. It takes its oxygen out of the atmosphere. But above the atmosphere, what is required to keep it in motion?

Dr. **Duncan**. The concept of the mission is that while you are in the atmosphere you accelerate to very high speeds and then you coast out into beyond the relm of the atmospere. There will be some liquid oxygen carried by the vehicle to be used for maneuvering in space and also to deorbit, but it uses the same engines.

Mr. **Miller**. And no boosters?

Dr. **Duncan**. And no boosters.

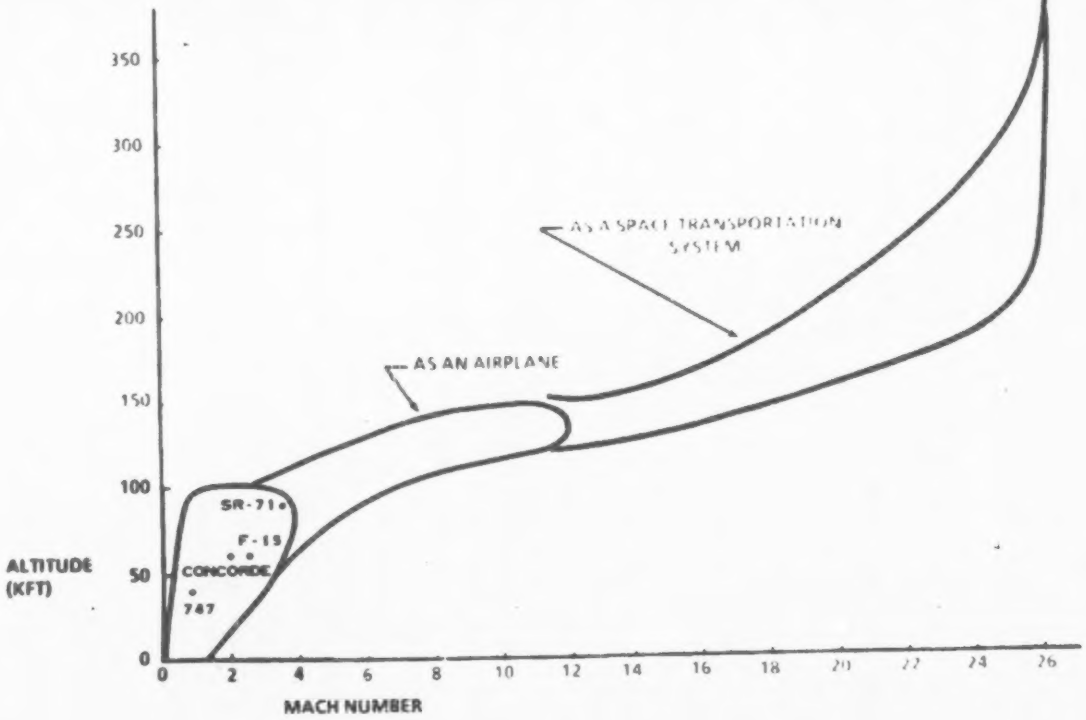
[Clerk's note.—Classified slide removed.]

If I could use the next slide to show the applications, you see it as a single space plane, hypersonic, ———. There are many military functions.

The next slide shows the envelope of operation of the system.

[Slide follows:]

ATMOSPHERIC FLIGHT ENVELOPES



4666/SSW/QW25/1

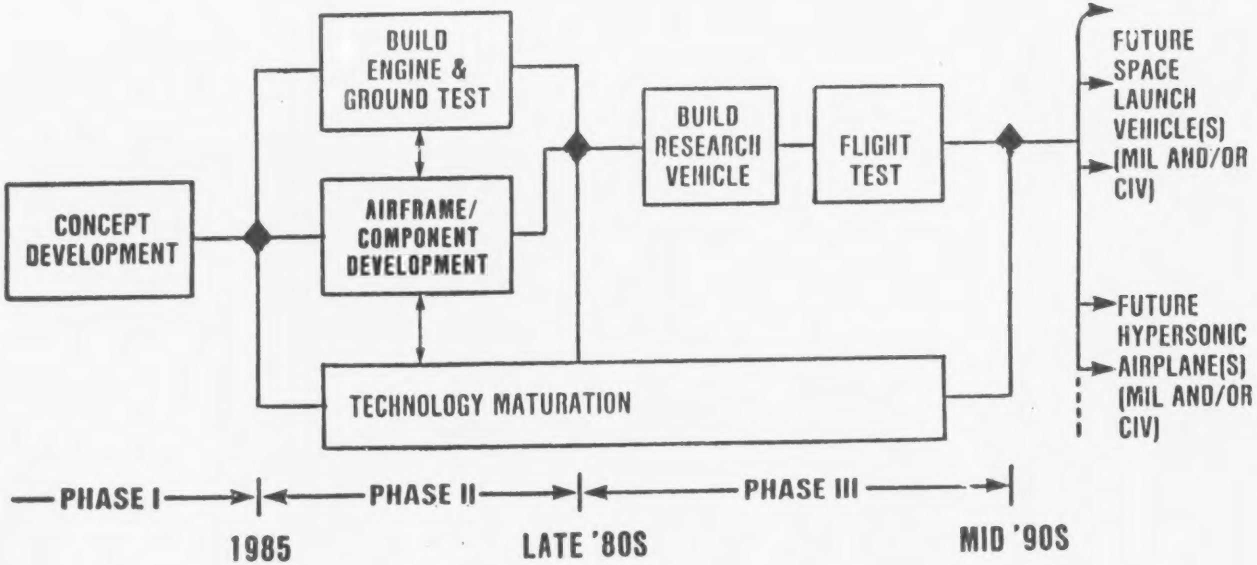
Dr. DUNCAN. This shows the point. This is mach number up to 25. This is altitude up to on this chart 350,000.

Here is a 747. Here is the Concord, the F-15, the SR-71 is the furthest one out in the envelope of today's operation. The aerospace plane will extend the envelope all the way up into space and the concept of flight is that as a—probably as a transport, it would operate in this regime here, I say probably because it might operate in a further-up regime as a transport.

As a space vehicle, it goes all the way up here.

[Slide follows:]

NATIONAL AERO-SPACE PLANE PROGRAM


CONCEPT DEVELOPMENT
BUILD ENGINE & GROUND TEST
AIRFRAME/ COMPONENT DEVELOPMENT
TECHNOLOGY MATURATION
BUILD RESEARCH VEHICLE
FLIGHT TEST
FUTURE SPACE LAUNCH VEHICLE(S) (MIL AND/OR CIV)
FUTURE HYPERSONIC AIRPLANE(S) (MIL AND/OR CIV)
PHASE I
PHASE II
PHASE III
1985
LATE '80S
MID '90S

Dr. **Duncan**. Now, the program we have, the national aerospace program, if we can have the next slide, is in stage 2 of vehicle development, the technology development phase. We will actually build and test the engines. That is the most critical subsystem, although there are a number of other critical areas.

I want to emphasize it is a high risk program in the sense that it is going to take time and it is going to take a comitment. It is going to take technological development, but we believe it is doable, and that is why we believe it should be started at this time.

During phase 2, we will be bringing these technologies along, and we will be establishing an X vehicle program which will be phase 3 of the program that the Air Force will be responsible for.

The Air Force has the overall responsibility for the program, DARPA is leading in the phase 2 piece of it.

Mr. **Miller**. As planned, is that a six-engine plane?

Dr. **Duncan**. We are not far along, sir.

Mr. **Miller**. Not that far along?

Dr. **Duncan**. I want to emphasize that this X vehicle program will be like the X-15. There will be vehicles that are testing the technology, and they won't look like this. There will be one, two, or three of those, but that will lead to a whole family of vehicles, one of which might be a transport like this. More than likely it will be, one of which will be a space vehicle.

Mr. **Miller**. Thank you.

Thank you, Mr. Chairman.

GALLIUM ARSENIDE PRODUCTION

Mr. **Dicks**. Tell us a little bit about your work with the Strategic Defense Initiative Office.

Dr. **Duncan**. Historically the SDI Office took a lot of our people and dollars and programs. DARPA—before my time—contributed a great deal to the core of strategic defense. At this time we are managing one major program for them that is important to them, the gallium arsenide production program which DARPA has an interest in also and which DARPA has the skills to provide.

Mr. **Dicks**. Describe that program. What does it do?

Dr. **Duncan**. Well, gallium arsenide is an electronic material. It is a follow-on to silicon that has a number of characteristics better than silicon.

One of those characteristics is nuclear hardness, radiation resistance. The SDI is interested in it primarily from that standpoint.

Another characteristic that is of interest to the general community is that it is faster. A characteristic some of us do not like is that it is costly, but silicon was costly, too, until it got into volume production.

What we are trying to do is develop production capability to get gallium arsenide into volume, into products so it can come along and become cost competitive at some point in time down stream that would make it viable not only for military applications, but other applications as well.

Mr. **Dicks**. I see.

Dr. Duncan. I would say the greatest single problem in producing it is that it does take extremely good gallium arsenide material—but silicon did too, and they found ways to make it.

Mr. Dicks. Anything else?

Mr. Efford. No.

Mr. Dicks. Thank you very much. We appreciate your presentation and ask that you respond to the balance of the questions for the record.

Dr. Duncan. Thank you.

[Clerk's note.—Questions submitted by Mr. Dicks and the answers thereto follow:]

IMPACT OF CONGRESSIONAL REDUCTIONS

Question. Due to the protection of SDI from Gramm-Rudman-Hollings budget reductions and a chronically low obligation rate, DARPA's funding for FY 1986 has been reduced 15 percent (over $115 million) from the level appropriated this past December. DARPA's budget was also reduced 9 percent from the appropriate level for FY 1985.

Dr. Duncan, OSD financial data indicates that DARPA was hit harder than any other service or agency by Gramm-Rudman-Hollings and other unallocated Congressional reductions. How has the agency absorbed these reductions?

Dr. Duncan. The allocation of these reductions to specified programs has been very difficult and will cause some program cancellations. The full impact is not yet known and the impact statement provided in response to a subsequent question is a first cut as full assessment is still underway. Also, some jointly funded programs between DARPA and the Military Service are impacted and Service notifications are still underway.

Question. Please provide a breakdown showing the allocation of these reductions by program and project, as well as impacts on program scope or schedule.

Dr. Duncan. DARPA sustained a total $117.4 million reduction of the FY 1986 TOA of which $47.5 million was attributed to a general reduction and $69.9 million for the Gramm-Rudman-Hollings education. The following table lists this combined reduction by program element.

[Dollar amounts in thousands]

Element code and title	Approp	Reduction	Total
61101E—Def Res Sci	$92,000	$12,772	$79,228
61103E—Univ Resch Init	6,250	835	5,415
62102E—Tech Studies	1,500	142	1,358
62301E—Strategic Tech	259,900	43,158	216,742
62702E—Tactical Tech	102,000	16,660	85,340
62707E—Particle Beam	21,500	3,391	18,109
62708E—Integrated Comd/Control Tech	53,000	8,632	44,368
62712E—Materials Tech	31,000	4,298	26,702
62714E—Nuclear Monitoring	20,900	3,243	17,657
63226E—Exp Eval of Maj Innov Tech	183,249	22,819	160,430
65114E—Blacklite	4,000	378	3,622
65898E—Mgmt Hq	12,148	1,148	11,000

Element code and title	Approp	Reduction	Total
Total	787,447	117.476	669,971

The allocations of these reductions to specified programs has been very difficult and will cause some program cancellations. The following impact statements which are categorized by major thrust may represent the initial cut as a full assessment is still underway.

a. *Counter Stealth*—Program Element 62301E—$10.0M; Program Element 62702E—$6.7M; Program Element 63226E—$7.3M.

[Classified details are special access and not provided.]

b. *Armor/Anti Armor*—Program Element 61101E—$10M; Program Element 62702E—$10M.

The FY 1985 DSB panel or Armor/Anti-Armor competition, chaired by retired General Donn Starry reported a serious deficiency in U.S. armor/anti-armor capabilities. The Secretary of Defense memorandum to the Under Secretary of Defense for Research and Engineering asked for a plan to implement the DSB fundings and described the problem as one approaching a matter of national urgency. USDRE and the DSB have asked DARPA to establish a strong armor/anti-armor program using industry, the DOE laboratories and universities to redress the imbalance. The program has been established with the Army and Marine leadership and integrated into the light and heavy family of vehicles program to enable fielding of weapon systems to close the gap by the mid 1990's. Restoration of these funds is essential for DARPA to initiate the program as directed by the DSB to critical technology deficiency areas. Major emphasis will be given to new hypervelocity kinetic energy penetrators to provide the viability and lethality of the U.S. 105 tank armament and to develop a new family of high lethality vehicles. Chemical energy (shaped charge) warheads will be developed to detect heavy armor with man portable anti-armor devices. Improved lightweight armor will be developed to provide survivability for the M-60 and M-1 vehicles and the Marine LAV and Army light vehicles. Cooperative support of the NATO allies will be solicited for this activity. Further, results of the SDIO research in kinetic energy weapons will be factored into the program. Delay until FY 1987 would cost the DoD more than the elapsed time in closing these technology gaps as much of this research which was initiated in FY 1985 or earlier will lose momentum by the delay in the ramp of funding.

c. *Teal Cameo*—Program Element 63226E—$15M.

This classified DARPA activity represents the major DoD support to advance Unmanned Air Vehicles (UAV). These programs, reviewed and endorsed by the Joint Requirements and Management Board (JRMB) of the Joint Staff include a tri-Service long endurance successor to Aquila as well as a high altitude theater UAV aimed at providing alternatives for an unmanned successor to the TR-1 and JSTARS platform. Included in the DARPA program are activities focused toward these vehicles and the advancement of sensor test programs which are unique to this class of vehicles and light regimes. Lack of these FY 1986 funds will suspend the critical test in "Revolutionary" materials and sensor suites. This suspension will impact the exploitation of these much needed technologies, and in some cases will result in the total termination of the programs at the critical phases. This impact will significantly delay, not only those programs affected, but also all the UAV programs that are in progress and require the technology to gain maximum potential and capability from the investment.

d. *Strategic Computing*—Program Element 62301E—$33M.

The Strategic Computing Program, DARPA's highest priority program, has dual goals: developing Fifth Generation computing technology for Defense, so as to counter Soviet numerical superiority with advanced technology capability; and, assuring the U.S. computer industry continued world leadership. The key to success lies in new supercomputer architectural designs with the potential of a thousand times performance improvement by 1987.

The effects of the reduction are: (1) All modeling and simulation of the new architectures will stop and no *full scale* prototypes will be produced, tremendously increasing the technological risk; (2) none of the reduced scale prototypes will be procured for development of software on the new architectures; (3) industry-university links that were established to transfer technology to the commercial sector will be eliminated or delayed. Companies involved include AT&T, BBN, GE, Encore, Harris, Hughes, IBM, SDC, Thinking Machines, and TRW: universities involved include Berkeley, CMU, Columbia, Georgia Tech, MIT, Princeton, and Stanford; (4) no prototype architectures will be procured for military applications, impacting technology transfer to the Services and significantly increasing the technological risk that the applications will fail. The military applications include: overhead imagery analysis, jointly funded with CIA: high resolution SAR analysis, jointly funded with the Army; the Navy battle management system at CINC PACFLT; and, the Air-Land battle management system jointly funded with the Army; and (5) microelectronics project in water scale integration, optoelectronics, and packaging will be cut. These technologies are necessary for reducing the size of the new computer architectures, and those miniature supercomputers are in turn needed to produce "brilliant" weapons for DoD.

e. *Integrated Command Control Technology*—Program Element 62708E—$8.8M.

The jointly funded DARPA/Army Distributed Communications and Processing Experiment (ADDCOMPE) was severely scaled back and consideration is being given to cancellation. This is a testbed program to develop distributed ADP applications for evaluation in a tactical operational environment, evolve innovative system concepts and doctrine for distributed processing in Army concepts for the 21st century.

The Survivable Adaptive Planning Experiment (SAPE), a key C^3I program supported by DARPA, RADC, SAC, and JSTPS, is being delayed one year. This impact on other joint participants has not yet been determined. The experiment focuses on survivable communications and post nuclear attack adaptive planning.

This reduction also places a one year hiatus on DARPA's planned improvements to VLSI foundry automation which is needed by increasing user agencies. Included were high resolution geometries for VLSI circuits.

A one year delay will be experienced in initiation of computer aided logistics support research directed by DepSecDef memorandum.

f. *Nuclear Monitoring Research*—Program Element 62714E—$3.2M.

This Program Element supports DARPA's research on detection and characterization of nuclear explosions in support of U.S. participation in treaty-related international activities such as the Threshold Test Ban Treaty ———.

These funds were needed for completion of construction work in the summer months. Lack of funds will delay this project for at least one year, assuming funds can be provided in FY 1987. Initial results from preliminary tests indicate that results from the arrays may be of higher value than the Norway stations. These funds were also needed to exploit the capabilities of the Norway seismic array.

g. *Particle Beam Research*—Program Element 62607E—$3.4M.

Loss of these funds forces cancellation of beam propagation experiments just short of the pivotal goal of injection of the ATA beam into open air. It further prevents full exploitation of recent experimental successes showing stable propagation at high density air through proper beam conditioning. It negates a far greater prior investment in preparation for these experiments and curtails the program at the peak of experimental output. It also compromises ———. As a consequence, the accomplishment of the program goals as reaffirmed by the 1985 DSB Summer Study on Tactical Directed Energy Weapons is prevented.

h. *Other Research*—Various Program Elements—$10.0M.

QUESTION. Would you explain to the Committee why DARPA's obligation rates are slower than the DoD average? Could you offer suggestions on how this situation might be improved?

Dr. DUNCAN. DARPA's obligation rates are slower than the DoD average for several reasons. First of all, DARPA does not perform its own contracting but rather relies on the Military Services and other government agencies to enter into contracts for DARPA programs. While the procedure has worked successfully over the years, procurement leadtime for research and development effort have increased significantly as a result of legislation and service procedures. In fact, with the implementation of the Competition in Contracting Act (CICA), procurement leadtime is projected to take over 250 days, an increase of 250 percent in the past ten years. Secondly, the impact of the Strategic Defense Initiative Program has delayed DARPA procurements since SDI program carry a higher priority, and use the same contracting agents as DARPA uses.

Suggestions for improving this situation include providing DARPA direct contract authority plus expanding the use of the general solicitation procedure in the CICA. DARPA is undertaking a study on direct contract authority which if provided, would allow a more efficient and timely budget execution process. DARPA is also investigating a provision of the CICA to expand the use of a general solicitation for basic research which if adopted could shorten the acquisition process by over 150 days for each procurement.

REAL GROWTH IN DARPA FUNDING

Question. Dr. Duncan, DARPA's FY 1987 budget represents a 25 percent increase over the FY 1986 level when adjusted for Gramm-Rudman-Hollings.

What accounts for this large increase?

Answer. The total growth in the FY 1987 budget of 25 percent includes increases in several technology program categories. The largest growth of 45 percent is in category 6.3, Advanced Development. The major contributor is the National Aero Space Plane Program which is budgeted at $60 million in FY 1987. The second largest growth of 28 percent is in category 6.1, Research. The University Research Initiative Program which is in its second year and requested at $12.5 million is more than twice the FY 1986 level and will achieve the full level of university research operations by the end of FY 1987. Also in category 6.1, Defense Research Sciences shows a total growth of over 20 percent primarily in materials and electronic sciences. Budget category 6.2, Exploratory Development reflects a total growth of over 17 percent in the following technology areas: Strategic Technology, Tactical Technology, Integrated Command and Control Technology and Materials and Electronics Technology. The largest increase is in the Tactical Technology program element.

Question. Within this overall increase, DARPA is requesting a 37 percent increase in funding for basic research. Given the large increase provided for technology base programs last year, how is continued growth of this magnitude justified?

Answer. The FY 1987 budget level reflects a total growth, including inflation, of 28 percent for category 6.1 research composed of two program areas as discussed in a previous answer. The University Research Initiative Program which is in its second year of funding is requested at $12.5 million. This is more than twice the amount funded in FY 1986 and will achieve the full level of university research operations by the end of FY 1987. Also in this category is Defense Research Science budgeted at a growth of over 20 percent in FY 1987 primarily in materials and electronics sciences necessary to support novel approaches in processing of ceramics and ceramic composites and exploring new concepts in electronic devices design.

Question. How would DARPA be able to effectively manage this degree of program growth when its funding for management and support activities shows a negative 4 percent real growth in FY 1987?

Answer. In general, the program growth is related to larger dollar programs with fewer contracts. Hence, there are less management requirements.

NATIONAL AEROSPACE PLANE

Question. Can you provide a rough estimate of the total RDT&E costs for this program? How much is currently budgeted for FY 1986 and prior years?

Dr. DUNCAN. Our current estimate is that Phase 2 and Phase 3 costs will total approximately three billion dollars. The FY86 budget is sixty-one million dollars. Prior to FY86 there were a number of separate technology efforts examining the general areas of interest to the NASP, but there was no aerospace plane program per se. DARPA did, however, have a program called Copper Canyon which examined the general concept of a NASP type program. Its total budget was $7.25 million.

Question. Is this technology critical to the success of SDI?

Dr. DUNCAN. Not necessarily. If the decision is made to deploy an SDI system in the future, it is clear that a relatively inexpensive means of launching such a system will be needed. Some reduction in launch costs can be achieved through improvements to the space transportation infrastructure and evolutionary advances in conventional rocket technology. The aerospace plane would be a major contribution to affordable SDI launch, but is is not the only answer.

Question. The British have a similar program called the HOTOL—Horizontal Take-Off and Landing.

How is the NASP different from this program?

Dr. DUNCAN. As we understand it, HOTOL is very different from NASP. The NASP is a research vehicle, an X-craft like the X-1 or X-15. The HOTOL is a developmental program aimed at fielding a commercial competitor to the Shuttle and the Arienne. The NASP will be a true single-stage-to-orbit vehicle. HOTOL plans to use a large trolley-like device to launch the orbitting vehicle. Because of the trolley, the HOTOL will have to be launched from dedicated, specially-equipped operational sites. Our goal is to make the NASP independent of specific launch sites. We plan to be able to operate from normal civilian and military airfields. The initial versions of HOTOL will be unmanned. NASP will be manned.

QUESTION. Are some similiar technologies being pursued? If so, which ones?

Dr. DUNCAN. Without divulging classified information, I can say that we see several areas of similar efforts and others which appear very different. The U.K. will also have to make advances in computational analysis techniques and materials. However, since the HOTOL, as presented, is not being designed for sustained hypersonic cruise within the atmosphere, its flight environment will be limited in comparison to the NASP flight envelope. NASP technology, therefore, will be more advanced in materials and will require a different propulsion concept.

Question. Would you explain the contracting strategy for this phase of the program? When will the initial contracts be awarded, and what work will they encompass?

Dr. DUNCAN. The contracting strategy for Phase 2 has three objectives: reduce technical risk, maximize competition, minimize cost to the government. In addition to awarding contracts to two engine and five airframe developers, we are also pursuing more than one technical approach in several of the higher risk areas. The engine and airframe contracts were awarded on 7 April 1986. A number of smaller ($2 million or less) contracts had already been let for areas with particularly long lead times. The awards to General Electric and Pratt & Whitney are 3 part contracts. In Part 1 they will conduct the studies needed to develop a preliminary design for a NASP engine module. During Part 2 of the contract, they will fabricate and test major components of the engine as well as continue their overall design effort. During Part 3, they will fabricate and test full-size, flight-weight prototypes of potential NASP engine modules. The airframe contracts are divided into 2 parts. In part 1, Boeing, General Dynamics, Lockheed, McDonnell-Douglas, and Rockwell will conduct design studies and analysis of key NASP issues which will lead to a engineering design review to be conducted by the Government team. Based on the results of that review, not more than three of the firms will be selected to proceed with Part 2 of the airframe effort. During Part 2, they will continue their design efforts and fabricate and test at full-size and flight-weight critical portions of the flight vehicle. Part 2 will culminate in each contractor producing a preliminary vehicle design.

QUESTION. The Committee is advised that this aircraft will have ejection seats. How will these be used in an aircraft designed to fly at a speed of mach 25?

Dr. DUNCAN. The design and operating conditions of all crew safety devices will be major factors in the eventual design and flight envelope of any aerospace plane. However, since both the actual vehicle design and its operating environment have yet to be defined in other than the broadest terms, the operation of crew safety devices such as ejection seats also cannot yet to be described in any meaningful detail.

QUESTION. The April 8 edition of the Wall Street Journal carries a story which states that contracts worth $500 million have been awarded for development of the National Aerospace Plane. Is this story accurate?

Dr. DUNCAN. The story is generally accurate. There are, however, four statements which need clarification or correction.

(1) "It would be able to ascend directly into orbit, cruise within the upper atmosphere at hypersonic speeds and land like an airplane."

The NASP would *either* ascend directly into orbit or cruise within the atmosphere. In either case, it would take-off and land like an airplane.

(2) "Each was awarded $175M to design, develop and ground-test the large scramjet engines for the plane."

While the total value of each contract is $175 million, only $6 million of that $175 million was obligated for FY86. Obligation of the remaining funds awaits the outcome of the FY87 & subsequent budget processes.

(3) "Contracts of as much as $32 million each for the main structure of the aerospace plane were awarded. . ."

Only two or three of the airframe contractors will have the options exercised to bring the total value of their contracts to $32 million. The initial competitive phase awards were for $7 million to each of the five contractors. The initial Government obligation for each contract for FY86 was $2.4 million.

(4) "The Reagan administration has estimated that it would need betwen $2 billion & $3 billion to build a test vehicle".

The current program estimate of $3 billion (in constant FY86 dollars) covers all of Phase 2 & 3 of the NASP program. Phase 2 covers the current work directed by DARPA. Phase 3, requiring a separate decision to proceed in the late 1980's, covers the fabrication *and* test of *2* flight test vehicles as well as a ground test vehicle.

Question. If contracts have been awarded:

How can this have taken place without prior authorization and appropriation by the Congress?

Answer. While the total value of the contracts awarded was approximately $450 million, they are incrementally funded R&D contracts. The FY86 obligations for the contracts totalled $24 million. That $24 million was authorized and appropriated by the Congress. Each of the five participating agencies requested and received in their final budgets authority to conduct research related to hypersonic flight. The $24 million represents an amalgamation of those previously authorized and appropriated funds. The remaining contracts funds are and will be requested in the FY87 and subsequent budgets.

Question. When were these contracts awarded?

Answer. The contracts were all awarded on 7 April 1986.

Question. When was the Congress notified?

Answer. Since the face value of each contract, as incrementally funded, is less than $50 million only the members whose districts were affected were notified on 7 April 1986.

Question. What funds have been obligated?

Answer. As discussed in answer A., the obligations for FY86 are $24 million.

Question. In what specific appropriations accounts, and in what amounts, were funds identified?

Answer. All contracts were awarded using Air Force, DARPA, Navy & SDIO R&D Appropriations. The amounts obligated per contract were:

Contractor	Program element	Millions
Boeing	63202F	$2.0
	62761N	.4
General Dynamics	63202F	2.0
	62761N	.4
General Electric	63224C	6.0
Lockheed	62301E	1.2
	63211F	.6
	62761N	.6
McDonnell-Douglas	62301E	1.0
	63202F	1.0
	62761N	.4
Pratt & Whitney	6322C	2.6
	63211F	3.4
Rockwell	62301E	1.8
	62761N	.6

Question. What cancellation provisions do these contracts contain?

Answer. All contracts contain both the Termination for Default (52.249-9) and the Termination for Convenience (52.249-2) clauses as well as a Limitation of Government Obligations (LOGO) clause which sets specific fiscal year limits on each contract. The LOGO clause limits the contracts to the $24 million of FY86 funds unless the Government increases the limit of its obligation in FY87 and beyond.

STRATEGIC COMPUTING

Question. DARPA's single largest program is Strategic Computing, which involves specific military applications of supercomputer technology. This program is budgeted at $146 million in FY 1987.

Over one-third of the FY 1986 appropriated funding for Strategic Technology has been eliminated due to undistributed reductions and Gramm-Rudman-Hollings. How has this affected the Strategic Computing projects?

Dr. DUNCAN. Major computer architecture development projects were delayed and slowed down. Acquisition of new architectures and insertion into the military applications programs was deferred until FY 1987. Work in VLSI design rules and other initiatives in micro-electronics necessary to achieving the next breakthrough in computer performance was delayed or deferred.

Question. Does the reduction in FY 1986 funding indicate that less work will be ready for FY 1987 than was originally planned?

Dr. DUNCAN. Because the major consequence of FY 1986 reductions was to delay start and slow the rate of research we are in an excellent position with contracts in place to accelerate the research in FY 1987 and regain lost momentum. Sustaining reductions in FY 1987 similar to those in FY 1986 would require outright cancellation of effort.

LONG RANGE INTERCEPTOR EXPERIMENT (LORAINE)

Question. DARPA's work in strategic bomber and cruise missile defense includes the Long Range Interceptor Experiment (LORAINE). This involves the development of a very long-range precision-guided weapon which could kill ——— aircraft. Although the initial test flight of this weapon system in April 1985 was highly successful, DARPA has withdrawn all further funding for FY 1986.

Would you explain the potential applications of this technology?

Dr. DUNCAN. Focus of the LORAINE program has been on development of technology for a non-nuclear very long range, high velocity, anti-atmospheric threat weapon launched from ship, land or air that could kill ———. The development is intended for Naval battle group and Continental United States (CONUS) air defense applications. An active sensor could detect and track hostile targets and would guide the maneuvering weapon to the target. By virtue of its speed the LORAINE could attack distant aircraft in a matter of minutes. By having a large search area the LORAINE minimizes the need for accurate pretargeting information, and could operate with or without in-flight updates as the scenario dictates. It is ideally suited to complement long range surveillance systems such as Over-the-Horizon (OTH) Radar and Space Infrared (IR) systems. These latter systems can be used to provide the outer air defense for Naval battle groups since it is sized to fit in shipboard vertical launch tubes.

Question. Briefly summarize the results of the April 1985 flight test.

Dr. **Duncan**. SWERVE-III was launched on April 20, 1985 from Kauai on a LORAINE-type ———. It flew near Johnston Island where it was illuminated and tracked by an X-band radar. Signals from the tracking radar were received at the array, processed by onboard electronics/instrumentation, and telemetered to ground. All SWERVE, experimental and instrumentation systems operated well. Array performance was measured during approximately one and one-half minutes of high-altitude cruise. In all, about two minutes of experimental RF data were obtained. Post-flight analysis revealed excellent beam quality, monopulse performance, and system survivability.

Question. Would you consider this "high risk, high payoff" R&D? Is this not the type of work that is central to DARPA's mission?

Dr. **Duncan**. Yes.

Question. Would this technology be of value to the National Aerospace Plane program, given the common requirement for a sensor which can withstand thermal loads at speeds of mach 10 and above?

Dr. **Duncan**. Yes ——— and T/R module technologies in particular.

Question. Provide a funding profile for LORAINE, by year of funding.

Dr. **Duncan**: FY86—2.5M; FY87—15.OM; FY88—18.OM; FY89—22.OM; FY90—12.OM.

This program is currently under review as a consequence of FY 1986 budget reductions. Some restructuring may be necessary to achieve the proper balance between missile and sensor investments. The Committee will be informed of substantial changes to the above funding profile.

Question. How was the threat and requirement which LORAINE is designed to address described in the Outer Air Battle Study completed in 1983?

Dr. **Duncan**. The threat focused on ———.

The study further specified both engaging the threat A/C as far out from the force as possible, and an operational requirement for a long range Surface to Air Missile that can be fired beyond the Continuous Air Patrol engagement radius. The LORAINE design exceeds these Long Range Surface to Air Missile requirements.

ADVANCED CONFORMAL SUBMARINE ACOUSTIC SENSOR (ACSAS)

Question. The Advanced Conformal Submarine Acoustic Sensor (ACSAS) involves the development of a conformal sonar array which would cover a large portion of the submarine's bow surface. The larger array size would allow significant increases in detection capability.

DARPA is planning to turn over funding for this program to the Navy beginning in FY 1988. Is DARPA convinced that the Navy will expeditiously move this technology into the fleet?

Dr **Duncan**. ACSAS' key technology involves an alteration of the ship's ———.

The schedule is funding constrained.

Question. ———?

Dr. **Duncan**. ———.

Question. DARPA's budget justification material states that the planned use of the SSN-21 ¼-scale model for ACSAS development had to be abandoned, and that the current plan is to use a new construction submarine as the full-scale test vehicle.

Why was the original plan changed?

Wouldn't it be extremely risky to use a new construction submarine as a test vehicle for this technology?

What was the cost and schedule impact of this change?

Dr. DUNCAN. There has been no change in the plan for test and demonstrating ACSAS technology ———.

Question. What is the estimated total RDT&E cost for ACSAS, and how much has been appropriated to date?

Dr. DUNCAN. ———.

ARMOR/ANTI-ARMOR

DARPA is planning to accelerate its funding for armor/anti-armor research and development, from approximately $45 million in FY 1986 to $85 million in FY 1987.

1. What types of technologies are included in the accelerated effort, and in what range of years might such systems be fielded?

Dr. DUNCAN. Although there is a fairly solid definition of the problem—U.S. armor and anti-armor systems are not as good as the threat counterparts—there is no well-defined solution to the problem; hence, no preconceived notions as to specific technologies that will be considered or excluded in the DARPA Armor/Anti-Armor program.

Certainly there will be work done in the physics of kinetic energy and chemical energy penetrators, the armor materials to stop them, the design of armor systems and anti-armor munitions, lasers, millimeter wave and infrared sensors and seekers, etc. (the obvious approaches). But the basic guideline is that any proposal involving any technology will be carefully reviewed by a wide variety of scientists and, if found to have some promise of providing a payoff in the armor/anti-armor area, will be pursued given that funds are available.

Currently there are proposals that will likely be funded in the following areas:

a. armor protection systems

Passive—materials (ceramics/metals): designs; physics.

Active—sensors (millimeter wave and infrared to detect incoming projectiles) defeat mechanisms: Shoot down—lasers/guns, fire control—smokes/aerosols/"force fields"

Reactive—designs; Materials (explosives, metals, etc): Physics.

b. kinetic energy penetrators: materials; physics; designs (shape, length/diameter ratios).

c. chemical energy penetrators: Design of shaped charge liners (shape, diameter, materials); explosives (more energetic, less vulnerable).

d. Munition guidance—missile and projectile fire control: Beam rider—lasers, millimeter wave, infrared fire and forget.

e. Munitions propulsion: Projectiles (in-gun, out-of-gun); RAMJET; light gas; propellants.

f. Systems integration: Vehicles; munitions.

The time period being considered is from today to whenever the job is completed—actually a never ending process with DARPA involvement being fairly heavy for the next 5–8 years and the Army assuming a larger level of involvement each year. We would expect the first products to be ready for fielding within 3 years—basically small improvements to guns, bullets, vehicles, etc. and probably being fielded as product improvements to the current inventory. The larger pay-offs should be ready for fielding within 5–10 years and beyond; again, an on-going process. We would expect to see some significant payoffs for the Army's Armored Family of Vehicles Program which is expected to begin fielding new armored vehicles in the mid-90's.

QUESTION. Is this work guided by, or consistent with, the priorities established in the Antiarmor Munitions Master Plan?

Dr. DUNCAN. The work is not necessarily guided by but is consistent with the Antiarmor Munitions Master Plan (AMMP)—the AAMP being a near team effort and the Armor/Antiarmor being mid to far term. DARPA has worked extremely closely with Headquarters Army personnel (those coordinating the AAMP) and is currently staffing an MOU with the Department of Army. There will be no conflict with the AMMP.

PACKARD COMMISSION RECOMMENDATIONS

QUESTION 1.The February 22, 1986 Interim Report to the President by the Packard Commission recommended that DARPA's role in advanced development be expanded.

What is your opinion of this recommendation?

Dr. DUNCAN. I think that the recommendation is an excellent one. DARPA's traditional strengths of technology development and streamlined management have provided many successes in prototype demonstrations. DAPRA's capability can significantly enhance DoD's application of technology for increased military capability.

QUESTION 1. Has DARPA been given any direction to begin planning or programing for such a change?

Dr. DUNCAN. There have been a series of OSD memoranda on responding to the Packard Commission Report. Specifically in regard to direction to DARPA, there is a 14 April 1986 memorandum from the Office of the Under Secretary of Defense for Research and Engineering to Director, DARPA which tasks DARPA to develop a recommendation for review by USDRE on the prototype issue.

[CLERK'S NOTE.—End of questions submitted by Mr. Dicks.]

WEDNESDAY, APRIL 9, 1986.

OFFICE OF THE DIRECTOR, DEFENSE, TEST AND EVALUATION

WITNESS

DR. JOSEPH A. NAVARRO, DIRECTOR, DEFENSE TEST AND EVALUATION

INTRODUCTORY REMARKS

Mr. DICKS. Dr. Navarro, it is nice to have you here. I am sorry about the lateness of the hearing.

Dr. NAVARRO. That is quite all right.

Mr. DICKS. It is late and we will be here late this evening and we appreciate your patience.

I understand you have a presentation. Why don't you go ahead and proceed as you wish.

Dr. NAVARRO. I will keep it very short if I can.

Mr. DICKS. Fine. That is fine.

OPENING STATEMENT OF DR. NAVARRO

Dr. NAVARRO. What I would like to do is present to you what our organization is all about and the work we are currently doing.

[Slide follows:]

DUSDRE(T&E) RESPONSIBILITIES

- OVERSEE/ASSESS DT&E ACTIVITIES OF MAJOR WEAPON SYSTEM PROGRAMS
- PROVIDE EXECUTIVE DIRECTION TO SERVICES ON DoD TEST SUPPORT RESOURCES
- MANAGE EXECUTION OF PROGRAMS FUNDED BY THE INDEPENDENT APPROPRIATION
  - PROGRAMS TO ENHANCE T&E CAPABILITIES
    - JOINT TEST & EVALUATION PROGRAMS
    - ADVANCED THREAT SYSTEMS
    - LRP FOR TEST SUPPORT RESOURCES
    - IMPROVE MANAGEMENT PRODUCTIVITY
  - FOREIGN WEAPONS EVALUATION PROGRAM
  - NATO COMPARATIVE TEST PROGRAM

RESPONSIBILITIES

Dr. Navarro. The organization that I head has three basic responsibilities. I will categorize our programs into one of these categories.

First, we oversee all of the weapons systems programs that are currently in the acquisition process, particularly those still in the early part of the DSARC process. We monitor and assess those programs relative to the developmental test and evaluation activity that is conducted throughout the life of that program. This means that we stay with a program from its inception to when it goes out into the field and into the inventory.

We provided at each of the milestones an assessment of the developmental testing areas to the acquisition executive and to each of the DSARC principals.

This is a very significant part of the work that we do. Currently we have approximately 120 different programs that are being monitored by six of my professional staff.

In any one year, there are on the order of 35 to 40 DSARC meetings held which divides out to roughly six to seven programs that each of these staff members monitors each year.

Mr. Dicks. How many people do they have working for them?

Dr. Navarro. None, sir—secretaries, you mean, or professionals?

Mr. Dicks. Professionals.

Dr. Navarro. Those six are the total staff that monitors these programs. They are supported by the head of the unit, who is an assistant secretary, and his secretary.

I will show you a vugraph of the organization in a few minutes.

Mr. Dicks. All right, go ahead.

Dr. Navarro. The second area of responsibility is that of providing executive direction to the Services on a variety of DOD test support resources. We provide executive direction to the major Test Ranges and Facilities Base. There are some 19 different facilities that have been designated as major test facilities. We monitor those programs that are going on in those test bases over the year, specifically addressing their Improvements and Modernization program.

Our purpose is to ensure that first, there is no redundancy in the system, that we are not building a capability at one base which already exists insufficient amounts at another base.

We just don't have the need for two. We monitor to be sure we don't get involved in duplication.

Second, we look at the total requirements needed downstream for facilities and instrumentation, testing instrumentation, and then encourage the services to develop programs to provide that implementation. So when a weapons system comes downstream and is ready to be tested in the developmental phase, there is adequate instrumentation for testing.

So we are looking long range for what the needs are as well.

The third area is where we manage the funds appropriated by your committee to our office. Currently there are three funds, three separate PE's.

Again, I have broken those up into each one. We have programs that have started over the years and new programs to enhance our

T&E capabilities. Specifically when I say T&E, I am talking about developmental T&E, which is our responsibility.

Under one Program Element, we fund the Joint Test and Evaluation Programs (JTEP). We currently have five programs that are ongong, three of which are oriented at developing tests beds where we can test subsystems or systems in a Command, Control and Communications (C^3) environment. This is an environment where we have the Soviet C^3 equipment, and we put in systems to see how well we can counter them.

This is to help us develop the capability in the early phases of the weapons system acquisition process so that we are building into it the capability to do what the services would like us to do, and test it very early.

A second test and evaluation Joint Test and Evaluation Program deals with the Identification, Friend or Foe or Neutral, (FFN), which relates essentially to the NATO air defense environment. This is a program which is based on hardware, man in the loop simulator capability, tying together many of the air defense capabilities that the U.S. will have in NATO should we go to war. This allows us to test changes in doctrine, tactics or equipment to see how well we can survive, the friendly air can survive, in that kind of an atmosphere. So it is a fratricide type problem.

The third Joint Test and Evaluation deals with the Forward Area Air Defense activity which is the short-range Area defense system that is currently being employed by the U.S. We are looking at the capabilities of those systems to detect and engage enemy aircraft and also the fratricide problem.

These are testbeds which are developing. In about 1989 we will turn these over to the military services for them to incorporate in a long-term testing program that they have in these areas.

I say hopefully we will do it. We are in the process now of identifying which Service to designate to pick these up and carry them on into the future. We have put a lot of money into these programs, and it isn't the kind of program where you say, "I could do it, let's go home." We are trying to leave a capability that will be used in the future. We have two other programs under the joint test program.

One is the Joint Live Fire program, and the other is the Electro-Optics Countermeasures, Counter-Countermeasures program. That has been going on now for 12 years. We have established a capability to allow us, and the Services, to expose EO systems to countermeasures and counter-countermeasures in a laboratory type environment being as realistic as possible if you can, and trying to measure whether or not you can countermeasure these and whether there may be counter-countermeasures.

We send a lot of the EO activity to that joint test facility for testing. He does probably on the order of 30 to 40 tests a year. What we are trying to do here is to improve our capability to develop systems which will work out in the field.

Each one of the last two programs is an individual PE. There is the Foreign Weapons Evaluation Program, which your committee is well aware of, you established that program, and the recent new one, the NATO comparative test program sometimes called the NATO side-by-side testing program.

I believe these two programs are extremely important. Over the last five years we have invested $50 million into the Foreign Weapons Evaluation program to do the testing in order to make sure that the specifications are indeed what they were claimed to be and that it does match with the U.S. equipment that we are trying to match it with.

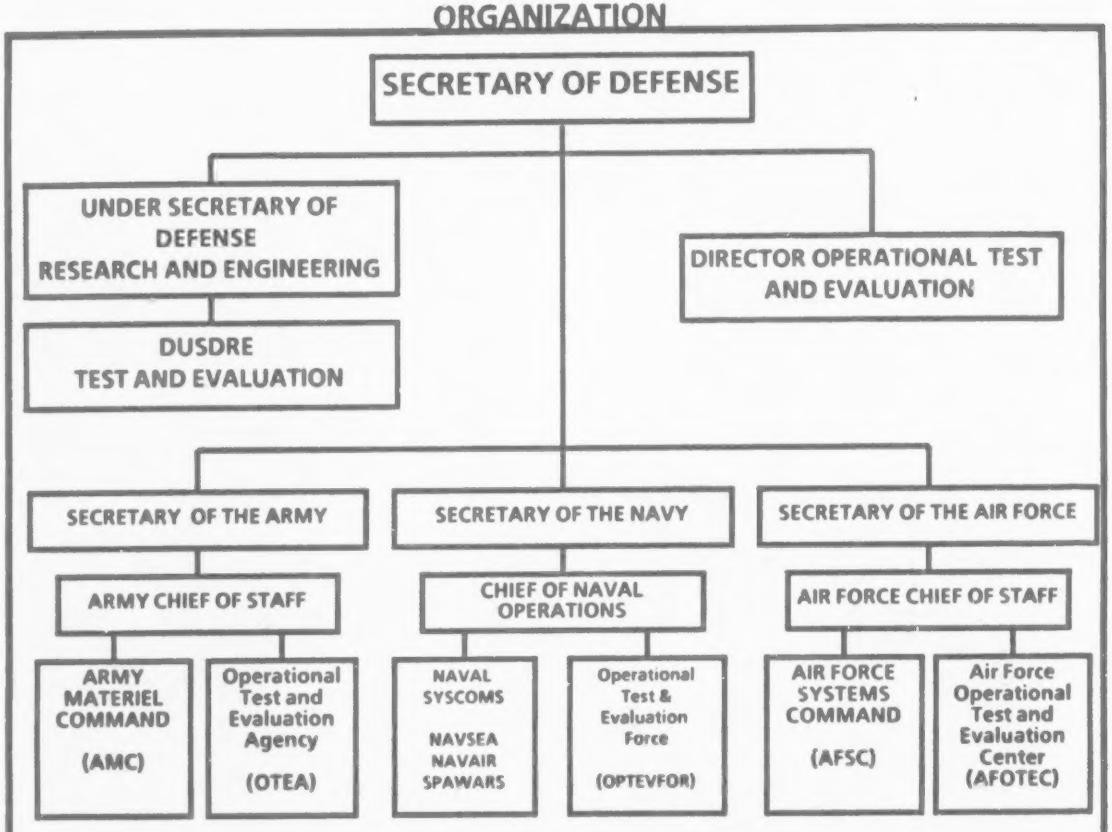
From that $50 million investment, we have procured $2 billion of hardware, which gives us about a 40 to 1 return on investment. Currently if we were to do business with U.S. developed systems, we are looking at something like about a 3.2 to 3.3 return on investment.

ORGANIZATIONAL BREAKDOWN

The next chart is an overview of where we fit in the organization. I report to the USDR&E. Mr. Jack Krings, DOT&E, who is up next, reports directly to the Secretary.

[Slide follows:]

ORGANIZATION


SECRETARY OF DEFENSE
UNDER SECRETARY OF DEFENSE RESEARCH AND ENGINEERING
DUSDRE TEST AND EVALUATION
DIRECTOR OPERATIONAL TEST AND EVALUATION
SECRETARY OF THE ARMY
ARMY CHIEF OF STAFF
ARMY MATERIEL COMMAND (AMC)
Operational Test and Evaluation Agency (OTEA)
SECRETARY OF THE NAVY
CHIEF OF NAVAL OPERATIONS
NAVAL SYSCOMS NAVSEA NAVAIR SPAWARS
Operational Test & Evaluation Force (OPTEVFOR)
SECRETARY OF THE AIR FORCE
AIR FORCE CHIEF OF STAFF
AIR FORCE SYSTEMS COMMAND (AFSC)
Air Force Operational Test and Evaluation Center (AFOTEC)

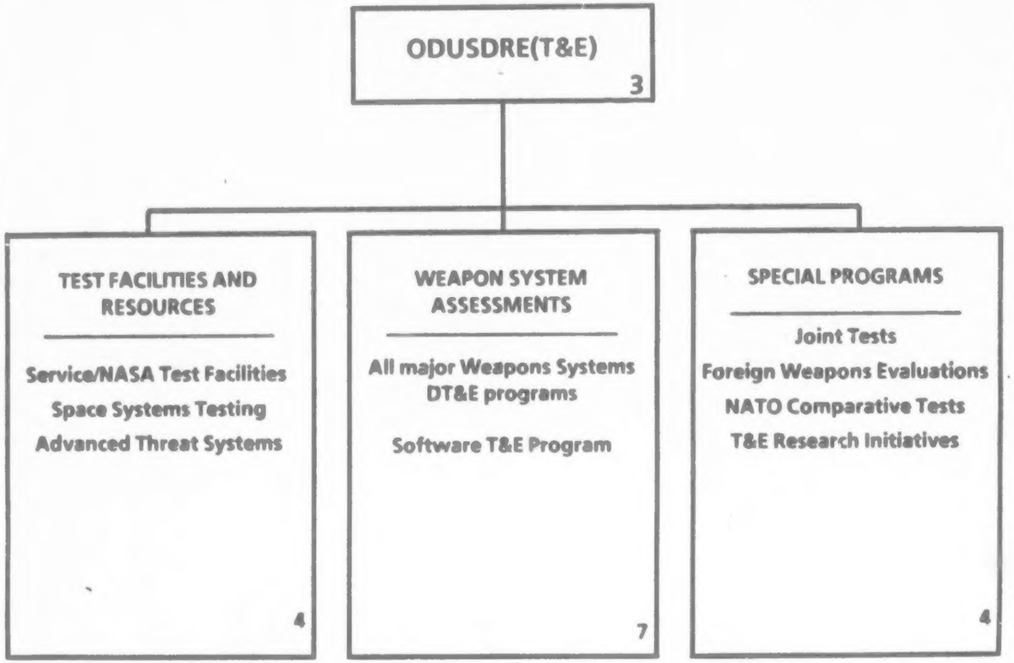
DOD TEST AND EVALUATION ORGANIZATIONAL STRUCTURE

Mr. DICKS. How do you break out the difference? You are handling the developmental issues?

Dr. NAVARRO. Yes, and Mr. Krings is doing the operational part. The bottom row of my chart shows essentially who we deal with. We deal primarily with the Material Commands of the various Services. The Army, Navy and Air Force Systems commands manage the development testing activity that takes place within each Service and those are the organizations we deal with. They report directly to the Material Command.

My particular organization will look like this as soon as it is formally approved which I understand is just an administrative matter.

[Slide follows:]


ODUSDRE(T&E)
3
TEST FACILITIES AND RESOURCES
Service/NASA Test Facilities
Space Systems Testing
Advanced Threat Systems
4
WEAPON SYSTEM ASSESSMENTS
All major Weapons Systems DT&E programs
Software T&E Program
7
SPECIAL PROGRAMS
Joint Tests
Foreign Weapons Evaluations
NATO Comparative Tests
T&E Research Initiatives
4

OFFICE OF THE DUSDRE TEST AND EVALUATION

Dr. **Navarro**. What I show in the next slide is that we are divided into three different functions and those functions are very much lined up with our responsibilities. Your particular appropriations funds all the Special Programs activities plus the software T&E program——

[Slide follows:]

DUSDRE(T&E) RESOURCES

	FY 86	FY 87	FY 88
TEST & EVALUATION			
Total PE 65804D($M)	76,490	75,799	79,868
FOREIGN WEAPONS EVALUATION			
Total PE 65111D($M)	17,010	18,010	18,010
NATO COMPARATIVE TESTING			
Total PE 65130D($M)	25,000	47,991	?
Total Appropriation($M)	118,500	141,800	?
PERSONNEL(Authorized)	24	24	?

Mr. DICKS. Give me more about the software T&E.

Dr. NAVARRO. That is an activity which we started about three years ago to enhance the capabilities in my office to look at the software testing program that the services are proposing to conduct during the acquisition of the particular weapon system and to help us to evaluate whether or not that program is indeed meaningful.

These are the programs which are shown through the test and evaluation master plan. If those programs in our view are leading to some major problems downstream because you have software and hardware being developed, and somewhere they are going to have to be integrated; if we feel that the services are developing a plan which will not fit together very well, then we want to say stop, let's rethink that. Let's look at the planning.

This activity allows us to make that judgment.

We have experts from Georgia Tech University who are—who have been working this field for years in the defense area and understand this business. They will work with us and we will also then ask them to work with the services to help improve their test plan if we find that the services aren't responding.

Mr. DICKS. What will your relationship be with the SDI Office?

Dr. NAVARRO. Right now we have no immediate relationship. We have started a study which falls under test facilities called Space Systems Support Testing. What we are trying to do here is to look at the requirements, what should we be worrying about relative to space testing/space systems; and SDI is one of these.

Mr. DICKS. Would survivability be one issue? Would that fall in your area?

Dr. NAVARRO. In the long run, yes. You would have to have some capability to look at the testing program which is assuring—rather than survivability, because survivability ends up being an operational term which includes a lot of other things. I would rather talk about vulnerability which addresses the probability of a kill if I had a hit.

There may be a lot of ways to keep survivability down when vulnerability is very high, by hiding or being very maneuverable and so forth.

The survivability issue would be looked at by Jack Krings, and his people in terms of the total picture. Issues we look at are: How do you do space testing? Do we have a platform in space to take data? If you do it underground, how can we generate the environment?

Mr. DICKS. The SDI was talking about having a test bed program.

Dr. NAVARRO. Yes. We are working with the people who are setting up that test bed program, but only in the sense of looking at the requirements for space systems testing. We are not personally involved—I don't think our plans are to be involved with the SDIO test bed itself directly.

Mr. DICKS. Okay.

PERSONNEL

Dr. NAVARRO. The numbers in each of the corners, on the chart indicate the total research staff including the management. When I said that we had six people in the weapons systems assessment that was the Assistant Deputy Under Secretary plus six other people who report to him.

So our total staff in this office is 18 professionals. We are supported by six support people, secretaries and so forth. This chart shows our resources. The first column, fiscal year 1986, shows what has been funded for this year. The fiscal year 1987 column is what we submitted or what we are requesting and 1988 is our plan.

I might bring out two points. One, on the NATO Comparative Testing; this year was the first year any funds were put into the 65130 PE. If we are successful in the NATO Comparative Testing Program as we have been in the Foreign Weapons Evaluation Program, we believe we could productively utilize $50 million in fiscal year 1987 toward the testing for procuring more non-development items (NDI) for the services. I believe the services are now starting to organize, structure and think more toward that direction, and if we continue with the success we have had that will be a very good investment.

Mr. DICKS. It says personnel. You have 24 people?

Dr. NAVARRO. Yes, sir.

Mr. DICKS. You are spending $118.5 million in 1986 and potentially $141.8 million?

Dr. NAVARRO. I have a request in now for four more staff. One will support the NATO Comparative Testing Program. Right now we have one individual who is assigned to the FWE program full time for the last year, year and a half.

With the increase in the workload relative to the NATO comparative testing, we are integrating both of those together.

Mr. DICKS. How do you use all that money? Is it the cost of the test?

Dr. NAVARRO. Yes, basically it is the testing cost, it is the cost associated with taking a foreign system and modifying it so it will fit the system that we are trying to test. If you bought a radar, you need to worry about how it plugs into the aircraft or into the vehicle that you are looking at and once we have done that we also have to worry about paying for the cost of replacing it.

We procure very little hardware in this program. The hardware is usually given to us. The foreign countries would like us to use it to test it because they are really looking to sell items downstream. So much of the work, almost all the work, is related directly to the testing activities. The services do all the testing.

We pay just for the test unique activities. We don't pay the services for their manpower and so forth they use to do the testing. We have something on the order of, I believe something like 60 or 70 programs currently going on by the services. So when you break it out, it is only a few million per program. There are very few large programs.

Mr. DICKS. Do you use contractors or do you do it all in-house?

Dr. NAVARRO. We have not used any contractors on the FWE or NCT programs. If I can not increase my manpower, I will have no other recourse.

Mr. **Dicks**. We will recess while we vote.

[Brief recess.]

Mr. **Dicks**. Dr. Navarro, you may proceed.

Dr. **Navarro**. In view of the time, I will end my presentation here and provide the remainder for the record.

[The statement and biography of Dr. Navarro follow:]

STATEMENT BY THE DEPUTY UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING (TEST AND EVALUATION)

Thank you for inviting me to discuss the Test and Evaluation programs and issues that are part of my responsibilities as the Deputy Under Secretary of Defense for Research and Engineering (Test and Evaluation) (DUSDRE(T&E)).

INTRODUCTION

This office supports the Test and Evaluation capability of the Department of Defense in four major areas. Principally, we oversee and assess the development test and evaluation activities of major and selected weapon system programs, we provide executive direction to the Services on development of test support resources, we manage the Foreign Weapon Evaluation and NATO Comparative Test Programs and we manage the execution of programs funded by the independent appropriation of the DUSDRE(T&E).

TEST AND EVALUATION OF MAJOR WEAPON SYSTEMS

The development testing process associated with the major weapon system acquisition process begins with this office providing executive level direction and coordination between DoD and Service staffs during the pre-DSARC phase and continues throughout all phases of the acquisition process. Prior to the formal T&E activities conducted by the Services, we review and (in conjunction with the Office of the Director, Operational Test and Evaluation (ODOTE)) approve the major weapon system Test and Evaluation Master Plans (TEMPs) to ensure adequacy of the T&E planning process. During the conduct of development tests we monitor the test procedures and test results in order to provide an independent assessment of the test results. This assessment is formally incorporated into the DSARC process. Policy guidance for specific development T&E areas such as software reliability, availability and maintainability testing is also provided to the Services through the various DoD Directives and Manuals maintained by this office (again in conjunction with ODOTE).

DOD TEST SUPPORT RESOURCES

This office's responsibility related to the DoD test support resources base is to ensure efficient and effective utilization of existing and planned test support resources . Our goal is to validate capability improvements, minimize Service duplication of capabilities and avoid underutilization of Government facilities. Since the funding for most DoD test support resources is contained in the Services' budgets, we exercise our executive direction through the PPBS process. The specific areas under our direction are Service developed threat simulators, aerial targets, and test ranges. A brief description follows.

Threat Simulators

In the threat simulator area, our role is to ensure the timely acquisition of these essential test resources and the integration of these assets into the DoD test ranges. Toward this end we provide direction to the Services to acquire those threat systems simulators needed to meet DoD-wide requirements.

During FY 87 the Army will be acquiring two upgraded anti-aircraft guns, three types of surface to air missile (SAM) simulators, and one land warfare missile trainer. The Navy will be acquiring a millimeter wave surrogate, two early warning/acquisition radars, a C^3 simulator, and a continuous wave target illuminator. The Air Force and the Army will jointly acquire an air defense fire control system simulator and the Air Force will be acquiring two types of SAM systems, one type of airborne radar system and a number of training emitters.

Aerial Targets

In the aerial targets area we emphasize the development and production of threat realistic systems for use in T&E. Since aerial targets are the prime means of stressing the acquisition and fire control subsystems of counter-air weapons systems, it is essential that targets with realistic signatures and flight performance envelopes are available for testing.

In FY 87, the Army will continue development of full-scale helicopter targets with authentic radar and infrared signatures, capable of flying realistic flight profiles using threat tactical doctrine; the Navy will continue development of anti-shipping missile threat targets with the Supersonic Low-Altitude Target (SLAT) having an IOC in FY 89; the Air Force will procure MQM-107 subscale subsonic targets jointly with the Army to gain attendant procurement and logistics economies (also full-scale F-106 airframes will be droned to provide a supersonic fighter airframe for test and evaluation for all Services).

Test Ranges

We provide direction to the DoD Major Range and Test Facility Base (MRTFB) which is comprised of 19 national test facilities under the direct management of the Army, Navy and Air Force. We provide overall policy direction and guidance to ensure adequacy to meet present and future requirements for testing, and to achieve optimum utilization of range assets. The MRTFB represents a $9 billion plus investment, manned by 55,000 full time military, civil service and contractor people, covering the total spectrum of test capabilities and disciplines needed for Defense weapon systems testing.

To ensure the adequacy of the MRTFB in fulfilling Defense testing needs, range assets such as real property, data acquisition and processing equipment, and mobile platforms are continually balanced against test support requirements. The entire spectrum of test resources of all Services is reviewed by ODUSDRE(T&E) with the intention of satisfying total DoD requirements with a minimum of duplication.

I would like to point out that about 80% of the total annual costs of the MRTFB are fixed and sustain basic operations. The remaining 20% is investment in new capabilities, preventative maintenance, improvement and modernization. As a result, seemingly small reductions against the total MRTFB request result in significant reductions (factors of 4 to 5) in improvements and modernization. If we are not careful, the future viability of the ranges and test facilities will be mortgaged to sustain the current testing workload. This has occurred over the past several years and if allowed to continue over the next several years, we can expect a serious increase in the obsolescence of test support capability.

EVALUATION OF FOREIGN SYSTEMS FOR U.S. USE

The Foreign Weapons Evaluation Program (PE65111D) and NATO Comparative Test Program (PE65130D) deal with the test and evaluation of Foreign Weapons for United States Forces use. The Foreign Weapons Evaluation Program funds the test and evaluation of allied weapons and equipment that have already been developed and have the potential to meet the requirements of the Services and save us the development cost and time to meet urgent field requirements. Over the past five years, with an average annual investment of under $10 M, this program has yielded 26 foreign items with a procurement value of over $2 Billion. This 40 to 1 ratio of RDT&E funding to procurement funding compares very favorably with the usual 3.2 to 1 return on RDT&E investment. The U.S. saves by eliminating research and development costs and has the added benefits of standardization and interoperability with allied forces . A report on the progress of this very successful program was submitted to your committee at the end of January.

This fiscal year (FY 86) marks the advent of a second test and evaluation program which focuses on testing of NATO systems and equipment as alternatives to U.S. equipment. This program is an outcome of the "Nunn amendment" on NATO Cooperative programs to the FY86 Authorization bill. The FY 86 Appropriation Act provided $ 25 M for this NATO program and suggested some eleven types of systems that the Department should consider for evaluation.

Building on the success of the Foreign Weapons Evaluation program, we have integrated the management of the NATO Comparative Test Program with the Foreign Weapons Evaluation Program in order to obtain the most comprehensive and economical approach to offer an opportunity for the Military Services to consider equipment from all over the free world as alternatives to development. In so doing, we have selected 19 projects involving 22 systems from 8 NATO countries that fall into 9 out of the 11 system and subsystem categories indicated in the Congressional legislation. While none of the programs is large, they all offer us an opportunity to evaluate a wide spectrum of equipment for use by U.S. forces. We notified your committee with regard to these systems late last month.

These two combined programs, in FY 86, will sponsor a total of 57 projects involving 77 systems, subsystems, components, equipment, and munitions from 12 allied countries (adding Israel, Australia, Sweden, and Japan to the NATO list). These programs hold the promise of increasing our forces' interoperability with the forces of friendly nations around the world at considerable savings in resources and time. It is a most appropriate use of a small portion of the overall defense budget and promises to pay even more handsome dividends in the future than it has to date.

As of today, 72 programs have already been identified as potential candidates for the Foreign Weapons and NATO Comparitive Test Programs through FY 88. In FY 87, over $25 M has already been programmed for these existing programs, and the selection process for new candidate programs is still in progress. Since we attempt to be responsive to DOD needs, and the type of programs normally chosen are at the component level, the selection process is purposely designed to be reactive. As requirements arise, the Services submit candidate proposals for immediate consideration. For the normal FY 87 planning cycle, the Services submit a package of candidate proposals by 1 August 86. These proposals are reviewed by OSD, prioritized, and then a final selection is made so as to remain within budget. Typically, several worthwhile programs will not be selected simply for affordability reasons.

TEST AND EVALUATION PROGRAMS FUNDED BY PE65804D

There are three principal activities within this program: joint test and evaluation, advanced threat systems and independent activities.

JOINT TEST AND EVALUATION PROGRAM

The Joint Test and Evaluation Program is a significant portion of PE65804D. Three of the current Joint Tests emphasize engineering design and exploratory research activities to develop methodologies, testbeds, models, simulations and/or procedures. The determination of vulnerability/susceptibility of equipment and the development of instrumentation and analytical data bases is the subject of the other two Joint Test & Evaluation Programs. The costs incurred under this program element are those which are unique to a Joint Test involving two or more Services. The Services participating in these tests provide equipment, weapons systems, and manpower without reimbursement. A summary of the five tests that will be in process through FY 87 follows:

The Joint Live Fire Test is being conducted to determine the vulnerability of U.S. armored and aircraft systems to threat munitions and the vulnerability of enemy systems to U.S. munitions. The tests are providing and will continue to provide valuable information for system developers in terms of improvements to existing or developing systems in the areas of increased survivability and/or lethality. The tests are also being used to validate and update vulnerability assessment models. During the FY 86 armor program, the Soviet BMP (equivalent to the Bradley) and the T-62 tank are being tested. US anti-armor weapons being tested against these Soviet vehicles include the LAW and AT-4 anti-tank missiles, the BLU-97 and M42 bomblets, Basic TOW and TOW II anti-tank missiles and 105mm Kinetic Energy tank gun rounds. During FY 87, the U.S. Light Armored Vehicle will be tested as well as advanced Soviet armored vehicles. The FY 86 aircraft program involves testing the F-100 engine to destruction, F-15 and F-16 hydraulic systems, UH-60 tail boom and F-16 hydrazine tank. During FY 87, F-15 and F-16 wings and fuselages will be tested as well as F-404 engines for the F-18. Tests will also begin on a Soviet aircraft.

The Electro-Optical Guided Weapons (EO/GW) Countermeasures/Counter-Counter Measures Joint Test is being performed to determine the susceptibility of U.S. weapons to state-of-the-art countermeasures and to allow developers to take corrective or enhancement actions to make U.S. weapons more effective on the electronic battlefield. Countermeasure techniques and devices are being developed, susceptibility/vulnerability analysis are being performed, and static captive flight tests are being conducted on our full range of EO/GW systems (UV, IR, TV, Laser). These tests support a multitude of material acquisition projects. In FY 86, 25 tests will be performed on various systems including the HELLFIRE Laser Seeker, TOW-Bradley production demonstration test, the COPPERHEAD microprocessor, Navy IR MAVERICK, and the USMC TOW-HELLFIRE-COBRA System. Among the 40 systems or components that we are planning to test in FY 87 are the STINGER/POST, TOW-2, AH-64 EO systems, as well as the DRAGON, Low Level Laser Guided Bomb, Fiber Optic Guided Missile (FOGM), and Advanced Antitank Weapons System.

The Joint Forward Area Air Defense (JFAAD)Test Program is structured to provide a testbed which will allow the user to investigate methods to improve short-range air defense and reduce friendly air casualties from friendly fire. The testbed will use man in-the-loop computer modeling and simulation. The current development program is using small scale field exercises to obtain baseline data and validate embedded models. JFAAD will investigate how the total data available from current and developmental identification systems can be better used to support FAAD, how existing and experimental Command Control and Intelligence components can best be integrated, and where air space management information is required in the system. The test is making maximum use of newly developed command and control system simulators which will provide a tool for analysis of equipment and man machine interfaces. It is anticipated that the JFAAD testbed will provide a primary tool to test concepts for and assist in systems integration of the Army's Forward Area Air Defense Systems.

The Identification Friend, Foe or Neutral (IFFN) Joint Test program is developing a testbed for assessing U.S. capabilities within the NATO Air Defense C^3 System to perform the identification function. When operational, this testbed can be used by the R&D and operational communities to detect deficiencies in performance and identify potential near-term procedural and equipment modifications. The testbed consists of a real-time computer simulation in which Army, Air Force and NATO system interaction in a realistic threat scenario can be modeled and simulated. The testbed is being assembled using a building block approach where systems are added as the software modules are completed. Systems included in the test are PATRIOT, HAWK, F-15, SAM BATTALION and Brigade Fire Direction Centers, the NATO Airborne Early Warning E-3A System, the German Air Defense Control and Reporting System, the U.S. Modular Control Element, a special intelligence system, and voice/digital communications. The test has been designed to allow flexibility to implement alternate configurations, add additional systems in the future, and give an extensive test control capability.

The Command Control Communications Countermeasures (C^3CM) Test Force is developing and assessing various approaches to improve the capability of U.S. forces to disrupt the enemy's Command, Control and Communications systems. The test uses simulations, modeling and field exercises to perform their analysis. Both Red and Blue C^3 and C^3CM systems are evaluated and analyzed. The effects of fratracide on friendly and enemy systems at various echelons are being tested. The FY 87 program includes the continuation of system engineering testing, threat analysis, simulation and evaluation of various combat scenarious concentrating on the impact of jamming and/or destruction on Red Force communications nodes.

ADVANCED THREAT SYSTEMS

A crucial program supported by the Services' and DUSDRE(T&E) appropriations is the development of Advanced Threat Simulators. The goal of this effort is to assure the availability of simulators of threat air defense systems for testing, tactics development, and training. Our role is to provide oversight and centralized technical coordination of tri-Service programs to develop hardware simulators of Soviet weapon systems that will be used to conduct tests of U.S. weapon system capabilities in a realistic threat environment. This is accomplished through a Joint Executive Committee with representatives from OSD, the Military Departments, and DIA. This committee establishes policy and provides guidance to the Services. Specific objectives are to avoid duplication, to increase coordination among the Services in order to achieve earlier availability of conceptual designs, to achieve greater realism through simulation of design approaches, and to foster early surrogate testing using the best off-the-shelf free world systems as surrogates for the threat systems. Production and operation of simulators remains a Service function and the Services operate the testing and training ranges where they are employed. We will use $10.7 million to support engineering efforts to develop threat systems specifications for use in building hardware simulators, to conduct scientific technology assessments to identify future potential threats, and for technical analysis of surrogate candidates and the analysis of test data. A portion of these funds are being used to build an instrumented airborne seeker testbed that will fly trajectories representative of threat missiles and will be used to support electronic warfare systems testing.

The Army's FY87 resources will continue the development of advanced threat simulators for an early warning acquisition radar, two SAM systems tracking radars and a SAM missile seeker, and begin the development of a simulator for an anti-aircraft gun system and two threat helicopters. The Navy's FY87 resources will provide for the development of early warning acquisition and tracking radars as well as SAM missile seekers. The Air Force's FY87 resources will be utilized to continue the development of an advanced SAM acquisition radar, advanced SAM target tracking radar, and advanced SAM missile simulation.

These Service developments will support testing of a wide variety of platforms and systems including the B-1B bomber, the Advanced Technology Bomber, the Advanced Technology Fighter, the Advanced Cruise Missile, helicopters, and electronic countermeasure equipment.

INDEPENDENT TEST AND EVALUATION ACTIVITIES

Several independent T&E activities are currently being conducted to support the Secretary of Defense and Congressional inquiries. These include feasibility determinations on proposed joint test programs, management support efforts and long range planning for future test resources.

Each year the Department considers new joint test requirements that are proposed by the Joint Chiefs. Before any commitment is made to charter a joint test force and allocate funds, a feasibility determination is conducted. In FY 87, one or two candidate test requirements will be examined in depth to determine if a reasonable test can be accomplished within available time and cost limitations and whether the results will be of sufficient validity to answer the question being posed.

In response to Congressional and Secretarial mandates to improve management productivity in the area of test and evaluation, we are sponsoring investigations into the application of data automation techniques to enhance productivity in the management of joint tests and in the execution of our duties in support of the DSARC process within DoD. This includes the use of specialized technical expertise in areas such as linking of testbeds and software testing. In 1987, we expect to automate financial tracking functions and joint test resource control.

We continue to conduct long range planning for the acquisition of critical test resources such as threat simulators, aerial targets and range instrumentation in order to support the Department's goal of more realistic testing. Our analysis of future weapon system technologies will provide a basis for early programming of fiscal resources to insure test support systems are available when needed. In 1987, we will complete our preliminary investigation into the type of test resources that will be needed to test future space-based systems.

SUMMARY

During FY 87 we will continue to actively pursue our efforts to evaluate foreign equipment acquired under the Foreign Weapons Evaluation and NATO Comparative Test Programs. These programs will help us to achieve significant savings in Research and Development cost and to expedite acquisition and fielding of needed weapons systems.

In order to conduct realistic testing and acquire the information to support the acquisition process, we need to continue to improve and modernize our test ranges. We also need to develop and acquire the needed targets and threat systems necessary to create a realistic threat environment. All of these efforts will improve the quality of testing and result in better equipment being placed in the hands of our combat forces. In the recent past, funding constraints have delayed the required modernization of the MRTFB essential to cope with the increasing technological complexity and volume of testing of new weapons systems.

With your support of both our budget and the Services' range budgets, we will be able to provide timely development of the type of test facilities necessary to conduct the adequate, realistic, and effective testing so necessary to ensure weapons systems function properly and effectively.

JOSEPH A. NAVARRO

PRESENT ASSIGNMENT: DUSDRE Test & Evaluation

DATE ASSIGNED TO USDRE: Jan 16, 1986

CIVILIAN SCHOOLING:	BS	Central Conn. State Univ 1950
	MS	Purdue Univ 1952
	PhD	Purdue Univ 1955

EXPERIENCE

- o DEPUTY UNDER SECRETARY OF DEFENSE FOR TEST AND EVALUATION, OUSDRE (Jan 86 to Present)

- o SYSTEM PLANNING CORP
  - PRESIDENT, SYSTEM SUPPORT GROUP (Apr 85-Jan 86)
  - PRESIDENT & CHIEF OPERATING OFFICER (1982-Oct 85)
  - EXECUTIVE VICE PRESIDENT (1976-1982)
  - V.P. TACTICAL SYSTEMS DIVISION (1972-1976)

- o INSTITUTE FOR DEFENSE ANALYSIS
  - ASSISTANT DIRECTOR SYSTEMS EVALUATION DIV. (1970-1972)
  - SENIOR STAFF MEMBER, SCIENCE & TECHNOLOGY DIV. (1964-1970)

- o INTERNATIONAL BUSINESS MACHINES
  - MANAGER, TECHNICAL DEVELOPMENT, MANAGEMENT SCIENCES DEPT. (1962-1964)
  - RESEARCH STAFF MEMBER, STATISTICS & OR DEPT. IBM RESEARCH (1959-1962)

- o GENERAL ELECTRIC CO.
  - RESEARCH STAFF MEMBER & CONSULTANT STATISTICIAN, ADV. ELECTRON CENTER (1955-1959)

PUBLICATIONS, AWARDS, CITATIONS, SPECIAL RECOGNITIONS

- o Numerous Technical Reports and Publications
- o Honors: Who's Who in American Colleges & Universities, American Men of Science, Sigma Xi, Cosmos Club

STAFF RESOURCES

Mr. Dicks. Do you think six people monitoring—what did you say, 120 programs——

Dr. Navarro. Sir, it is 120, but not all are that active in any one year. When you break it down to which programs you are really working during the year, it is probably on the order of 35 to 40. So each staff member is monitoring on the order of six programs. It is a heavy load. As with most areas, you can put as much energy into the area or as little as you wish and you get out of it what you put into it.

I think six people is a little light. That is why in my request for additional staff I included two people in the program to help do the assessments.

A more important thing is the capabilities of the individuals, not just the numbers. I need people who have TE experience and have technology backgrounds so they understand what they are looking at when they are being asked to assess the technology and developmental testing issues in the early stages of these weapons programs.

Mr. Dicks. For the record, would you tell us what the other 18 people do.

Dr. Navarro. Well, six are secretaries. I know they are the most important.

Mr. Dicks. You are right about that.

Dr. Navarro. Of the four people working in the Special Programs area, one is assigned to monitor all the joint test programs with the exception of the life fire testing program.

I have one staff member, Colonel Burton, monitoring the live fire program. The other programs——

Mr. Dicks. You can put that in the record.

Dr. Navarro. Yes, sir.

[The information follows:]

My Deputy, Brigadier General (P) Jones, and I oversee the management of all development test activities for the Under Secretary. My executive assistant is responsible for seeing that the administration matters of the office are done effectively.

The Assistant Deputy Under Secretary of Defense (Special Programs) provides overall management and technical direction for all of the programs in his office and is responsible for managing the T&E Research Initiatives Program. One individual is assigned to the Joint Live Fire Program, another manages the other Joint Test and Evaluation Programs, and a third manages the Foreign Weapon Evaluation and NATO Comparative Weapons Testing Programs.

The Assistant Deputy Under Secretary of Defense (Weapons Systems Assessments) provides overall management and technical direction of the weapons systems assessments conducted by the staff in his office. The six professional review Test and Evaluation Master plans, monitor the development test activities and provide independent assessments of major and other selected weapon systems test programs to the Acquisition Executive and the DSARC Principals during all phases of the acquisition cycle.

The Assistant Deputy Under Secretary of Defense (Test Facilities & Resources) (ADUSD(TFR)), provides overall management and technical direction to the staff in his office and is responsible for oversight of the improvement and modernization of the Services' Major Range Test Facility Base (comprised of 19 major ranges). One individual manages the Advanced Threat Simulator System program, another the Space System Testing Support Planning and a third, with assistance from the ADUSD(TFR), oversees the Services' test support programs to ensure there is adequate planning and funding to meet future test support needs and no unwarranted duplications of test capabilities.

FOREIGN WEAPONS EVALUATION

Mr. **Dicks**. The foreign weapons evaluation program provides funding for the services to procure and test off-the-shelf foreign weapons to satisfy valid U.S. requirements with very little investment in development.

Mr. Navarro, your statement describes these foreign weapons evaluation candidate systems as those which "will have potential to meet requirements of the services and save us the development cost and time to meet urgent field requirements."

To what degree is the foreign weapons evaluation program used as a tool to reduce RDT&E costs already budgeted or programmed as opposed to providing a "window of opportunity" for other developmental items?

Dr. **Navarro**. It is my understanding under the Foreign Weapons Evaluation Programs that there is no existing competitor in the United States. You are buying something which you cannot buy in the United States. You could start a program from scratch or modify a program so you have a development activity to get to where you want to be. But in the Foreign Weapons Evaluation Program, I think it is part of the ground rules, there should not be a competitor in the United States.

That is not ture in the NATO program. The NATO program—in fact, in order to do testing in the NATO program area, you must have a conterpart in the United States because you are making a comparison against that counterpart to see if it is less costly, or could meet a better schedule or has better performance.

Mr. **Dicks**. The foreign weapons evaluation program appears to be focused in narrow areas such as chemical defense equipment, munitions and countermeasures. Is this by design?

Dr. **Navarro**. I think this is probably more related to the fact that there was a relatively small amount of money being put into the program over the first few years. The services when they put in their candidates for what they wanted to investigate, felt those systems better met their immediate needs. If we expanded the program, I think we would expand into other areas of the type of systems and subsystems that the service would request.

Mr. **Dicks**. We will have additional questions for the record on these subjects.

[**Clerk's note**. Questions submitted by Mr. Dicks and the answers thereto follow:]

NATO COMPARATIVE TESTING

Question. In FY 1986, Congress appropriated $25 million to initiate the NATO Comparative Testing program, which provides funds for side-by-side testing of U.S. and NATO weapons systems. $48 million is budgeted for this program in FY 1987. What projects have been selected for evaluation with FY 1986 funds, and how was the selection process conducted?

Dr. **Navarro**. The following 19 projects were selected for the FY 86 NATO Comparative Testing program. Specific details on these projects are contained in the report provided by the Deputy Under Secretary of Defense for Test and Evaluation to the House Appropriations Committee on 26 February 1986, in accordance with Section 1103(g) of Public Law 99-145.

Army Projects

GERMAN NBC RECONNAISSANCE VEHICLE

Evaluate the German Fuchs vehicle used by German armed forces as an alternative to the U.S. M-113 adaptation for the NBC Reconnaissance vehicle mission.

GERMAN ELTRO LAND MINE RECONAISSANCE AND DETECTOR SENSOR

Evaluate the ELTRO sensor as a potential land mine detection sensor device for incorporation into the U.S. Mine Reconnaissance and Detection (MIRADOR) system.

FRENCH MISTRAL AIR DEFENSE SYSTEM FOR HELICOPTER AND AIRCRAFT AIR DEFENSE MISSION

Evaluate the MISTRAL missile for use in a fixed-wing and helicopter-mounted adaptation for an air-to-air combat role as an alternative to use of the STINGER missile.

Navy Projects

FRENCH AND CANADIAN MAGNETIC ANOMALY DETECTORS FOR ANTI-SUBMARINE WARFARE

Evaluate the Canadian AN/ASQ-504 and French MAD Mk3 Magnetic Anomaly Detectors as alternatives to the existing towed AN/ASQ-81(V) or the new U.S. developed AN-ASQ-81 (VI) for application to Navy Anti-Submarine Aircraft.

BELGIAN 90 MM GUN FOR USMC LIGHT ARMORED VEHICLE

Evaluate the Belgian Mecar 90 mm gun as an alternative to the 75 mm gun under development in the U.S. for the USMC Light Armed Vehicle.

BRITISH AIR DEFENSE SYSTEM SITUATION DISPLAYS

Evaluate the British Ferranti and Thorn EMI large screen and direct viewing computer display systems for use in the Joint and Allied Air Defense System (JAADS) now under development.

Air Force Projects

NORWEGIAN PENGUIN MK III ANTI-SHIP MISSILE

Evaluate the Norwegian PENGUIN MK 3 Anti-Ship Missile as an alternative to current U.S. air-to-surface missiles to fulfill the need for a standoff maritime weapon for tactical aircraft.

FRENCH RUNWAY CRATERING MUNITION FUZE

Evaluate the Thompson-Brandt BAP-100 Fuze for runway cratering munitions as an alternative to the intended U.S. developed fuze for the Bomb Kinetic Energy Penetrator (BKEP).

BRITISH AARDVARK JOINT SERVICES FLAIL UNIT (JSFU) FOR AIRBASE RECOVERY OPERATIONS

Evaluate the Aardvark Joint Services Flail Unit (JSFU) as a candidate sytem for providing a direct supplement to the MK 126 MOD 1, Ordnance Rapid Area Clearance (ORACLE) blade or as the stand alone EOD clearance and submunitions disposal unit on Tactical Air Force installations.

BRITISH HUNTING AREA-DENIAL SYSTEM (HADES)

Evaluate the Hunting Area-Denial System (HADES) air delivered area-denial weapon system in conjunction with the UK HB-876 mine as a contender for the USAF direct Attack Airfield Cluster Munition (DAACM).

BRITISH MILLIMETER WAVE SEEKER FOR ANTI-ARMOR MUNITIONS

Evaluate the British Marconi Milimeter Wave Seeker as a potential alternative to the current U.S. Advanced Millimeter Wave Seeker program.

DANISH FLARE/CHAFF DISPENSER SEQUENCER

Evaluate the Danish ALE-40/47 sequencer switch as an alternative for the sequencer switch currently under development to replace an unreliable switch in operations Air Force Aircraft.

The process used to select the FY 1986 NATO Comparative Testing Program projects was basically the same as that used since FY 1981 for the DOD Foreign Weapons Evaluation Program. The principal criteria for selecting a candidate project were its potential to satisfy an existing or projected operational or taining requirement, technical maturity, and potential for procurement. Additional factors influencing candidate selection included: available test data, multi-service interest, sponsorship by a U.S. licensee, and realistic cost. The Services submitted lists of candidates by priority. The lists were reviewed by OSD, reprioritized by OSD and final selections were then made by the OSD staff to remain within the FWE program budget.

BRITISH NATO IDENTIFICATION SYSTEM RADAR MODE INTERROGATOR

Evaluate the British developed Radar Mode (RM) interrogator which provides IFF bearing resolution to match that of the airborne intercept radar.

NORWEGIAN AND CANADIAN 2.75" ROCKET PENETRATING WARHEAD

Evaluate the Norwegian Raufoss RA-79 and the British Aerospace WAU-5001B and BAH-002 warheads against U.S. M 151 warhead with M433 delay fuze for application to current Navy requirements for an inexpensive, unguided, air launched anti-ship munition.

GERMAN NAVAL DEPTH SOUNDER

Evaluate the German DSQN-12 depth sounder for application to new construction ships and for replacement of the current AN/

UQN depth sounder to support a procurement decision for FY 88 as an alternative to the U.S. AN/UQN-4, 4A, and other older systems in use.

GERMAN AND FRENCH SUBMARINE PERISCOPES

Evaluate the German Seiss search and attack periscopes, and two configurations of the French SAGEM PIVAIR Periscope against the capabilities of current U.S. Periscopes for application to the SSN-21 submarine requirement.

FRENCH 2.75" ROCKET MOTOR

Evaluate French 2.75" rocket motors as an alternative to current U.S. rocket motors for future procurement.

BRITISH OSBORNE ACOUSTIC MINESWEEPER

Evaluate, in a cooperative joint test program with the Royal Navy, the OSBORNE towed acoustic minesweeping device as an alternative to the US MK 4(V) and MK6(B) acoustic sweep systems for support of a FY 89 procurement decision in support of the AVENGER class of U.S. Navy Mine Counter-Measure ships.

NETHERLANDS CRYOGENIC COOLING ENGINE

Evaluate the Netherlands linear motor cryogenic cooling engine with a view to possibly replacing the present cryogenic cooling engine in the detecting and ranging set of A6E (AN/AAS-33A) and the navigation FLIR of the AV-8B and F/A-18.

NATO COOPERATIVE RESEARCH AND DEVELOPMENT

Question. Generally, cooperative programs between the U.S. and our NATO allies emphasize a "two way street" approach. The U.S. has now formally established and funded a program which could eventually bring significant business to European firms.

(A) What progress has been made in achieving reciprocal agreements with the defense programs of our NATO allies?

(B) Have any other nations formally agreed to commit their own funds for such a program? If not, when do you foresee such agreements?

Answer. (A) Public Law 99-145, Section 1103, has provided significant new impetus for two-way Allied cooperation in development of modern conventional weapons for the US and its NATO Allies. Together, we have undertaken an unprecedented level of activity toward initiating such cooperative programs. Six Statements of Intent to enter into specific projects have been signed by National Armaments Directors. Detailed MOUs are being negotiated on these and other potential programs. Equitable sharing of R&D costs is the basis for each project.

(B) Among the participating nations, no MOUs have been signed. Two have completed negotiation and are in coordination staffing for signature. We expect several to be signed within a few months. The MOUs will detail the project, contain specific milestones, and delineate funding responsibilities.

Question. The U.S. has several allies, notably Israel and Japan, which have significant defense technology programs, but are excluded from the Cooperative RDT&E programs since they are outside of NATO. Would the effectiveness of this program be enhanced if all of our allies were allowed to participate?

Dr. **Navarro.** The Department of Defense has a mechanism to evaluate systems from other than NATO countries through the Foreign Weapons Evaluation Program. The effectiveness of the NATO Comparative Test Program could be enhanced if the program was structured to allow other than NATO countries to participate, as is now done in the Foreign Weapons Evaluation Program.

Question. How does the management and conduct of the NATO Cooperative Testing program differ from the Foreign Weapons Evaluation program? Don't both programs have a common mission, namely the procurement and testing of foreign weapon systems for potential U.S. Application?

Dr. **Navarro.** DUSDE(T&E) manages both the NATO Cooperative Test and the Foreign Weapons Evaluation Programs under essentially the same procedures and under the same program manager. The major difference is that the NATO program is restricted to systems produced in NATO countries, and requires a comparison of the foreign system to an existing or in-development U.S. system. The Foreign Weapons Evaluation Program has much more flexibility. The systems under evaluation include systems from Israel, Australia, Japan and Sweden as well as NATO countries. Both programs have the common mission of testing foreign weapons systems for potential U.S. procurement.

Question. Why is no funding requested in this program element for FY 1988?

Dr. **Navarro.** DoD expects to request FYDP funding at the FY 87 level in the FY 88 President's Budget.

MAJOR RANGE AND TEST FACILITY BASE (MRTFB)

Question. The Department of Defense has stated that the Major Range and Test Facility Base (MRTFB) is in need of modernization due to past funding reductions. What is the overall state of the Major Range and Test Facility Base today?

Dr. **Navarro.** The MRTFB is able to support high priority testing which does not require major advances in range instrumentation systems performance. The bulk of the improvement and modernization (I&M) funding has been used to keep equipment functioning to support today's programs and little has been available to develop and acquire the range systems needed to support tomorrow's high tech test programs. Within the DoD our efforts to obtain adequate I&M funding for future test support have been successful in recent years. However, modest cuts by Congress in the overall MRTFB program have resulted in disproportionate cuts in the I&M program because the majority of the MRTFB funding is needed to conduct day-to-day operations in support of current test programs. This results in creeping obsolescence of the basic test range systems because cuts must be made in I&M projects which are not necessary to support active test programs. Adequate funds have not been available to develop and procure the range systems necessary to properly test advanced technology programs which require capabilities far beyond existing range instrumentation. In some cases the development program manager is forced to tailor his test program to fit the available instrumentation since the development of suitable test range instrumentation often requires as much time as the system under test.

QUESTION. Has DoD conducted a systematic evaluation of MRTFB modernization needs and prioritized those needs?

Dr. NAVARRO. We review each of the Services' near-term (3–5 years) Improvement & Modernization programs annually. This review gives us a better understanding of the underlying requirements for a specific modernization project in order to evaluate and prioritize the Services' programs. We have conducted, and are continuing to conduct, evaluations of future testing requirements within general mission areas, such as ballistic missile, cruise missile and space systems testing, to ensure that the highest national priorities for test support capabilities are met within the limited resources available for MRTFB modernization. We have not generated an MRTFB-wide project priority list, however the priorities within the various mission areas reflect our concern that the MRTFB be able to provide adequate near term support to the major weapons in the acquisition cycle.

QUESTION. The Undersecretary of Defense for Research and Engineering is responsible for providing policy guidance and direction to ensure the optimum utilization of range assets. However the Committee is advised that DoD does not routinely keep range utilization data, since there is no requirement to do so.

A. Is this accurate?

B. If so, how does OSD ensure that the ranges are utilized efficiently?

Dr. NAVARRO. A. There are no accepted range utilization rate standards in existence among the MRTFB because of the variability of their test missions. However, each Service keeps detailed utilization data for accounting purposes to allow proper charging for services rendered under the uniform funding policy. The unique character of each MRTFB operation results in considerable differences in what specific data is kept by the individual Service organizations and the level of detail recorded. Each range commander has the primary responsibility for ensuring his range is efficiently and effectively utilized. The backlog of workload is OSD's primary measure of utilization and that information is routinely reviewed.

B. The major programs being supported and the general level of activity at each MRTFB organization are scrutinized during the annual program reviews for duplication with other similar MRTFB operations and reasonableness in forecasting projected workload. If the DoD staff judges that an anomaly exists in the Services' programs then a more detailed and focused evaluation based on utilization data requested from the Services is conducted by the DoD staff to determine if unnecessary duplication exists and/or the facility is being effectively utilized. In the past these evaluations have resulted in the closure of facilities which were unnecessarily duplicative and/or significantly underutilized.

Question. Please provide the amount of funding programmed for FY 1985 and FY 1986, and budgeted for FY 1987 and FY 1988, for MRTFB Improvement and Modernization, by facility for each service.

Dr. **Navarro.** The following is a listing of the amount of funding programmed for FY 1985 and FY 1986, and budgeted for FY 1987 and FY 1988, for MRTFB Improvement and Modernization, by facility for each service.

[In millions of dollars]

MRTFB facilities by service	Fiscal year—			
	1985	1986	1987	1988
Army:				
Kwajalein Missile Range	10.0	14.7	24.6	31.0
Yuma Proving Ground	3.9	3.7	6.0	7.5
Aberdeen Proving Ground	4.4	5.7	7.3	9.5
Dugway Proving Ground	8.9	12.5	18.6	21.9
White Sands Missile Range	16.6	20.9	19.6	23.9
Electronic Proving Ground	11.8	6.5	8.9	16.6
High Energy Laser Test Facility	10.5	4.9	5.5	4.9
Navy:				
Atlantic Fleet Weapons Training Facility	8.5	0	0	11.4
Atlantic Undersea Test and Evaluation Center	3.6	3.8	5.7	5.6
Naval Air Propulsion Center	4.0	5.5	7.0	7.5
Naval Air Test Center	14.0	15.7	20.7	25.2
Naval Weapons Center	8.9	10.8	10.5	12.7
Pacific Missile Test Center	27.9	28.9	34.0	35.8
Air Force:				
Tactical Fighter Weapons Center	35.8	28.2	9.8	21.4
Air Force Flight Test Center	19.1	16.9	17.6	28.3
Utah Test and Training Range	2.9	5.8	15.9	12.6
6585 Test Group	1.9	5.8	7.8	8.4
Armament Division [1]	43.2	17.0	53.0	23.9
Arnold Engineering and Development Center	28.1	4.0	3.1	3.2
4950 Test Wing	12.4	12.8	35.4	36.1
Eastern Space and Missile Center	11.1	14.1	47.1	46.4
Western Space and Missile Center	10.5	6.9	21.7	17.4

[1] Includes GPS Range Applications Program which will support the majority of MRTFB activities.

FOREIGN WEAPONS EVALUATION (FWE)

Question. The Foreign Weapons Evaluation (FWE) program provides funding for the services to procure and test off-the-shelf foreign weapons to satisfy valid U.S. requirements with very little investment in development. Dr. Navarro, your statement describes FWE candidate systems as those which "will have potential to meet reqiurements of the Services and save us the development cost and time to meet urgent field requirements."

A. How does your office ensure that FWE canidates are not comprised of lower priority items which have not merited development funding by the individual services due to budget constraints?

B. How do you define an "urgent" requirement?

C. How do you denine a "valid" U.S. requirement?

D. Are the services required to submit a copy of the system's requirement document with the FWE application?

Dr. **Navarro**. A. Nominations are provided to the DUSD(T&E) through the Assistant Secretary level in each of the Services. By virtue of this review process, the programs are reviewed and prioritized by the senior military and civilian leadership in each Service. Once submitted the nomination receive an independent review within the Office of the Secretary of Defense to confirm the priorities and adjust them, if necessary.

B. The three primary considerations for a project to be selected for the FWE program are that there is an operational requirement or deficiency, the system to be tested is operational or in the final stages of testing, and there is potential for procurement. The Services determine their own urgent requirements before submission of canidate projects to OSD. These submissions are reviewed by expert OSD staff members, and at that point, priorities may be realigned as well as integrated among all Service requirements so that the most needed projects are funded and the most comprehensive program can be structured.

C. Each Service generates requirements through a formal process to establish a Statement of Need (SON) or a Required Operational Capability (ROC). These statements are reviewed by the Service staffs and valildated. In order to qualify for FWE funds there must be an established SON or ROC, or one in the formal process which the OSD staff believes will be validated.

D. The Service are not requried to submit a copy of a requirements document, but to address the existence of a requirement. These requirements are reviewed by cognizant OSD staff personnel to verify that requirements are in fact pressing and justifiabale.

Question. The Report to the Congress on the FY 1985 FWE program states that for the BOL Chaff Dispenser, which was evaluated by the Navy, "no formal requirement exists; however, there is a documented fleet desire." Is this consistent with the program policy that a requirement must be "valid?"

Dr. **Navarro**. Yes, at the time the report was written, the Navy had a *draft* Operational Requirement identifying a need for the BOL concept. It was determined in the OSD review process that the requirement would be validated, and that the evaluation proposal met the criteria for inclusion in the Foreign Weapons Evaluation Program.

Question. It seems reasonable to assume that program managers would prefer to evaluate canidate foreign weapon systems with their own funds rather than apply to OSD for funds. This would result in less OSD control of the evaluation and less administrative paper-work for the program office.

A. Are there restrictions on the authority of individual program managers to conduct their own evaluation of foreign weapons, independent of the FWE program?

B. How is your office notified of these plans, to avoid unnecessary duplication?

C. What incentives exist for program managers to apply for FWE funds instead of budgeting such funds in their own programs?

Dr. **Navarro**. A. No; service program managers have the authority to conduct evaluations of foreign weapons independent of the FWE program.

B. Although OSD is not *formally* notified of these plans, informal communications are quite good and information flows to OSD in several forms. In the review process at OSD during the selection process, various experts (staff members responsible for major weapons systems oversight) review the proposals and a primary consideration during that review is the avoidance of duplication, particularly among the Services. This is in addition to the review each candidate program receives at the Service level prior to submission to OSD.

C. Program managers have severe fiscal constraints. The FWE program can provide them with additional funding in a timely fashion. It also puts an OSD stamp on approval on his program that many program managers find useful.

Question. Please provide the dollar value of leases for foreign weapon systems which were evaluated in FY 1984 and FY 1985, and procurement cost avoidance resulting from those leases.

Dr. Navarro. The following systems were leased for evaluation in FY 84 and FY 85:

Program	Lease cost	Cost avoidance
French Aerial Radiac System	$62,337	$89,031
German NBC Recon Vehicle	44,000	1,356,000
French Missile Launch Detector	500,000	800,000
Total	606,337	2,245,031

Question. Please provide similar data for weapon systems which were loaned or given outright, resulting in no procurement costs.

Dr. Navarro. The following systems were loaned or given outright for U.S. evaluation in FY 84 and FY 85:

Program	Cost	Cost avoidance
Swedish Chaff Dispenser	0	$240,000
Israeli Decoy Launch System	0	100,000
German Low Altitude Dispenser	0	2,500,000
Norweigian Penquin Missile	0	[1] 4,600,000
Israeli HAVE NAP	0	[1] 3,000,000
German Anti-Shelter Weapon	0	1,000,000
French Cratering Munition	0	100,000
UK HADES Aerial Mine System	0	650,000
UK HB876 Random Delay Mine	0	25,000
Totals	0	12,215,000

[1] Projected.

[**Clerk's note.**—End of questions submitted by Mr. Dicks.]

FEW TECHNOLOGY BASE

Mr. Dicks. According to DOD documents, the evaluation of foreign technology base programs are being considered by the foreign evaluation program. Have any technology base evaluations taken place to date?

Dr. NAVARRO. I think one or two, but the emphasis is much more on the actual weapons program, and again I think that is because they are more important to the services.

Mr. DICKS. We will have additional questions for the record on that.

[CLERK'S NOTE.—Questions submitted by Mr. Dicks and the answers thereto follow:]

QUESTION. According to DoD documents, the evaluation of foreign technology base programs are being considered by the FWE program. Have any technology base evaluations taken place to date? Are any planned in FY 1986 or FY 1987?

Dr. NAVARRO. Even though the FWE program has the option to evaluate technology base programs, it has not done so in the past. The focus of the FWE Program is to evaluate systems which are sufficiently mature to quickly evolve into a procurement if the evaluation is positive. There are no technology base evaluations planned in FY 86 or FY 87.

QUESTION. How would such an effort be conducted?

Dr. NAVARRO. The procedures to select a foreign technology base evaluation project would be the same as those specified in the OSD direction to the Services for any other FWE project. An individual Service would determine that a requirement exists, that this requirement could be met with an existing foreign technology, and that, should that technology prove to meet the requirement, arrangements can be made to procure it (through MOU's, purchases, etc.). This proposal would be evaluated by the appropriate OSD staff experts, compared against existing or proposed DoD technology base programs, and, if determined that the project warranted the priority, the study would be authorized utilizing FWE funding.

[CLERK'S NOTE.—End of questions submitted by Mr. Dicks.]

Mr. DICKS. Mr. Miller?

DUSD (T&E) CONTRACTS

Mr. MILLER. Thank you, Mr. Chairman.

I have one question. I was concerned about the chart that I saw where you had something like $118 million budgeted, and about $141 million for 1987, as I recall. Yet, it had 28 or 24 employees.

Dr. NAVARRO. It was 24.

Mr. MILLER. So therefore it means you do a lot of contracting out, as I see it.

Dr. NAVARRO. Most of the contracting work that we have is to help us enhance the T&E capabilities in the community. We have contractors such as Mitre and the Institute for Defense Analysis who are looking at larger areas to help us do the planning as to what the requirements are downstream.

For example, we are just starting up an effort to look at the total picture of threat systems and how we should be providing that capability to the T&E community. The current approach we are pursuing is looking at development of threat simulators.

We are finding that to get there from here through that approach alone just won't ever happen.

We also have to look at surrogates, simulations, test beds and other ways in which we can test with realistic Soviet systems out in the field, so that we can test our systems against their systems.

That type of a study right now would not be able to be undertaken by my staff. One, we don't have sufficient staff; and two, they don't have the technical skills really to conduct that type of study. We will contract that study out.

This would lay out for us what our requirements would be over the next 4, 5, 10 years in order to give us the kind of capability in T&E that we are seeking.

Mr. **Miller**. You do not actually let out a contract to test. You didn't have the opportunity to read all of your statement, but I noticed in one paragraph that the F-110 engine would be tested to destruction.

Dr. **Navarro**. Yes.

Mr. **Miller**. How far do you go on that? Do you evaluate after someone else does the testing or do you allocate a contract out to someone to do that mechnical work of testing?

Dr. **Navarro**. The testing is actually done by the services. We do not do any testing. We oversee that testing. We look at the plan that they have and modify it if needed, improve it or we ask them but the actual conduct of the test is done by the services. The services may choose to use contractors to help them in gathering data and so forth, but that does not come through us. That would come directly out of the services.

Mr. **Miller**. What is the bulk of your funding used for then if you have so few personnel and it doesn't go for pay? What do you buy that would be that expensive if the services are doing the testing and furnishing the equipment?

Dr. **Navarro**. My previous remarks addressed the Foreign Weapons Evaluation Program and the NATO Comparative Testing Program.

In the Joint Test and Evaluation Programs, we are developing the test beds. We currently have three major programs, the C^{3}I CM, IFFN, and the JFAAD test beds. This year we will require on the order of, say, about $40 million to support those three programs. The project managers are procuring equipment and simulation capabilities. We pay for the test unique costs.

The services would pay for the staff that are assigned to these particular programs who are actually doing the testing. But when we buy hardware simulators, when we procure systems that will stay with these test beds and will be the mechanisms for the operations of the test beds, we procure that out of our budget.

TEST BED DEVELOPMENT

Mr. **Miller**. Could you give me an example of a test bed? Is is something that you would keep intact and be able to run one test and then as new technology comes along, you run another test?

Dr. **Navarro**. It would be——

Mr. **Miller**. Is it destroyed, so to speak, after the test?

Dr. **Navarro**. No. If we were developing test beds that would be destroyed after the one test, I certaintly hope we wouldn't spend as much money as we currently do on these test beds.

We are trying to build a more lasting capability which will allow the services to test components, subsystems and systems as well as their interface with doctrine, tactics and procedures. The IFFN program, for instance, relates to the NATO air defense environment.

So as we try to enhance or measure our capability to fight war in a NATO environment we have to worry about the identification problem and the impact that will have. This test bed will allow us to measure those capabilities as we bring new equipment into the active force.

Mr. **Miller**. Again, could you give us an example of a test bed.

Dr. **Navarro**. Let me try this. Let me stick with IFFN because that is a very good example of a test bed. This test bed takes into account all of the current capabilities we have in each of the air defense systems. For example, the HAWK system is embedded in this test bed through a module which ties directly with an operational HAWK battalion, which does not necessarily have to be colocated at the actual test bed where we would run the exercise when we do the testing. In the test bed, we try to as faithfully as possible reproduce the NATO environment that would exist today with the current systems that we have.

Once we have that system developed and validated—and that is what we are currently doing—we would leave that system for the services to use to test those improvements they are making in the out-years which will have an effect in the NATO environment.

So if someone says we want an improved HAWK which has the following capabilities, it has twice the range, it has half the IR signature, et cetera, we can put that in this test bed and measure the enhancement that would be provided.

The ability of our system in that kind of environment is what it tests.

Mr. **Miller**. And could be used for other——

Dr. **Navarro**. Absolutely, yes.

Mr. **Miller** [continuing]. For other units.

Dr. **Navarro**. It is not just for one test. We won't put it away. If we put it away, we will be putting away 50 to 60 million in hardware, which will have virtually no value downstream.

COORDINATION WITH NON-NATO ALLIES

Mr. **Miller**. You speak of NATO. What about our friends in the Pacific and our enemies in the Pacific? How do you fit into that? Only NATO has been mentioned here.

Dr. **Navarro**. We have not attempted to start any test beds that are outside of the NATO activity. We are concentrating primarily in the NATO area.

Mr. **Miller**. Will that be necessary in the future?

Dr. **Navarro**. If the environment is that different and we are going to invest lots of money in acquiring systems to deal with that environment, then we will need a capability to do that kind of testing.

Mr. **Miller**. We are not investing in that at the present time.

Dr. **Navarro**. Our office does not have anything currently planned, but we will certainly look into it.

Mr. **Miller**. Thank you, Mr. Chairman.

DUSD (T&E) CONTRACTS

Mr. MILLER. Provide a list of contracts using funds of the Office of the Director, Defense Test and Evaluation for the latest full fiscal year, and thus far for FY 1986. Include the recipient's name, the contract value, date of action, and a brief description of the work performed.

[The information follows:]

The following contracts were or are managed directly by the Office of Deputy Under Secretary of Defense (Test & Evaluation), formerly known as the Office of Director, Defense Test and Evaluation, staff:

TEST AND EVALUATION INDEPENDENT ACTIVITIES

Institute of Defense Analysis, Virginia, $405,000 (FY85), $475,000 (FY86). Provide NATO Central Region Airspace Control Review, Air Command and Control Systems Evaluation for Warrior Preparation Center, and electronic mail support.

BDM, Virginia, $2,285,000 (FY85), $1,057,000 (FY86). Provide Joint Test Support Center support, Decision Support System support, and Financial documentation support.

Georgia Institute of Technology, Georgia, $483,000 (FY85). Develop software for test and evaluation plans.

Clemson University, South Carolina, $496,000 (FY85), $350,000 (FY86). Develop and maintain Test & Evaluation network.

George Washington University, Washington, DC, $270,000 (FY85). Develop Test & Evaluation Master Plan, coordinate implementation of datalink vulnerability analysis methodology.

MITRE, Virginia, $465,000 (FY85), $592,000 (FY86). Provide instrumentation and procedures evaluation.

The following contractors were or are funded by the Services using funds provided by the Office of the Deputy Under Secretary of Defense (Test & Evaluation):

IDENTIFICATION FRIEND, FOE, NEUTRAL (IFFN) JOINT TEST

LOGICON, INC., California, $11,655,736 (FY 85), $6,873,348 (FY 86). Provide IFFN evaluation of tested systems.

Science Applications International Corporation, Alabama, $296,773 (FY 85). Upgrade and integrate Patriot Tactical Operations System computer with IFFN testbed and perform verification and validation of testbed development.

SYSCON, Washington, DC, $898,302 (FY 85), $1,465,000 (FY 86). Provide technical and analytical support and to perform verification of testbed development.

ITT Research Institute, Illinois, $35,843 (FY 85), $30,000 (FY 86). Perform electronic jamming evaluations (ECM).

OAO Corporation, Maryland, $77,360 (FY 85), $284,640 (FY 86). Provide computer operators and programmer support.

Elder Equipment Leasing Company, New Mexico, $14,206 (FY 85). Lease test support equipment.

Flinchum Construction Company, New Mexico, $1,513,000 (FY 85). Construct test support facilities.

Institute For Defense Analyses, Virginia $165,000 (FY 85), $25,000 (FY 86). Provide independent review and analyses of IFFN Joint Test Program.

JOINT LIVE FIRE (JLF) TEST

New Mexico Institute of Mining Technology, New Mexico, $101,000 (FY 85), $1,000,000 (FY 86). Provide joint test support.

Denver Research Institute, Colorado, $50,000 (FY 85), $50,000 (FY 86). Prepare test plans for FY 86 and FY 87 JLF testing.

Booze Allen & Hamilton, Ohio, $35,000 (FY 85), $165,000 (FY 86). Provide technical and administrative test support.

Synergy, Incorporated, Ohio, $20,000 (FY 85), $260,000 (FY 86). Provide test planning support.

Pratt & Whitney, Florida, $60,000 (FY 85), $68,000 (FY 86). Provide joint test technical support.

Kentron, Inc, California, $33,000 (FY 85), $120,000 (FY 86), Provide joint test support.

Armament Systems, Incorporated, California, $15,000 (FY 85), $24,000 (FY 86). Provide joint planning and analysis support.

Ross Aviation Corporation, Maryland, $10,000 (FY 85). Provide joint test support.

General Dynamics, Texas, $48,000 (FY 86). Provide joint test technical support.

McDonnell Douglas Aircraft, Missouri, $121,000 (FY 86). Provide joint test technical support.

Sverdrup Corporation, Tennessee, $23,000 (FY 85). Provide joint test support.

DSI Corporation, Maryland, $15,000 (FY 86). Provide joint test support.

Institute for Defense Analysis, Virginia, $388,000 (FY 85), $400,000 (FY 86). Provide independent analyses for JLF Test Program.

ELECTRO-OPTICAL GUIDED WEAPONS COUNTERMEASURES/COUNTER-COUNTERMEASURES (EOGWCM) JOINT TEST

Arvin/Calspan, New York, $670,261 (FY 85), $708,511 (FY 86). Provide on-site susceptiblity/vulnerability analysis of electro-optical guided weapons.

Kentron, Inc., Florida, $55,285 (FY 85), $57,933 (FY 86). Provide design and development of two standard hardened programmable pulse sequencers (HPROPS) and one modified HPROPS.

Perkin-Elmer Corporation, Connecticut, $33,149 (FY 85), $94,906 (FY 86). In FY 85 determined feasibility of and in FY 86 developed a laser bean transmission system using fiber optic cable.

Kazuko Enterprises, Inc, Florida, $12,383 (FY85), $32,772 (FY86). Development of a reactive laser.

Sylvania Systems, Western, California, $69,382 (FY85). Development of a high repetition rate laser.

Eaton Corporation, New York, $420,378 (FY85). Provide design and development of a laser radiometer system and reconfiguration for airborne pod capability.

KTECH Corporation, New Mexico, $87,912. Provide on-site senior electro-optical laboratory technician for laser maintenance and repair service.

RCA Corporation, New Jersey, $88,673 (FY85). Provide design and development of mid-infrared focal plane array camera.

American Electronics Lab, New Jersey, $31,500 (FY85). Provide design and development of a seeker optical correlation system.

Block Engineering, Massachusetts, $28,284 (FY85). Design and development a radiometer imaging thermal energy sensor.

[6] COMMAND CONTROL, COMMUNICATIONS COUNTERMEASURES (C^3CM) JOINT TEST

BDM, New Mexico, $1,290,340 (FY85), $2,642,782 (FY86). Provide computer operations and analysis of test data.

Consortium, New Mexico, $1,427,906 (FY85), $2,406,480 (FY86). Provide long range planning and instrumentation for joint test field exercises.

BDM, New Mexico, $6,659,754 (FY85), $12,840,738 (FY86). Perform test planning and analysis.

FORWARD AREA AIR DEFENSE (FAAD) JOINT TEST

COLSA, Incorporated, Alabama, $1,552,724 (FY85). Provide the Independent Verification and Validation Plan Schedule, and technical support to Threat Scenario document, FAAD Statistical Analysis Plan, Test Design Plan, and Analysis Plan development.

INTERCON, California, $550,345 (FY85), $457,023 (FY86). Provide technical support of FAAD test methodology and development of data requirements and data base administration.

SAIC, Inc, Virginia, $16,380,382 (FY85), $12,475,911 (FY86). Developm software requirements specifications, software design documents, site facilities design data and implement that data, i.e., build, assist in the operation, and maintain the entire FAAD test bed facility.

ADVANCED THREAT SIMULATORS

Applied Research, Inc, Alabama, $134,247 (FY85), $90,000 (FY86). Provide automated budget analysis and tracking system.

Dynetics, Inc, Alabama, $40,266 (FY85), $1,719,268 (FY86). Provide technical documentation, and technical test support.

Clemson University, South Carolina, $150,000 (FY86). Provide solid state component reliability analysis.

RCA, New Jersey, $250,000 (FY86). Provide broadband phased array antenna.

George Tech Research Institute, Georgia, $771,116 (FY85), $425,000 (FY86). Provide electronic warfare emitter, millimeter wave technology program support, signal simulator test support signal detection/acquisition research support, signal processor breadboard development, and technical analysis of radar technology.

MIT/Lincoln Labs, Massachusetts, $900,000 (FY85), $2,000,000 (FY86). Provide pulsed doppler radar data analysis, surrogate seeker development, and engineering and operational support of a radar system at Eglin AFB, FL.

Raytheon, Massachusetts, $2,000,000 (FY86). Provide surrogate seeker development.

FSTC, Virginia, $250,000 (FY86). Provide threat simulator development.

BDM, Alabama, $31,838 (FY85), $174,978.24, (FY86). Provide surrogate and threat systems technical specifications, Air Force requirements for threat simulators, and surrogate data base.

BDM, New Mexico, $49,886.25 (FY86). Provide directed energy technology analysis.

Hughes Aircraft, California, $1,099,220.85 (FY85), $336,931 (FY86). Provide tube arm design specifications, pulsed doppler surrogate radar.

Radian, Texas, $219,445 (FY85), $139,500 (FY86). Provide threat computer technology investigations.

Electronic Warfare Associates, Virginia, $395,238 (FY85), $300,000 (FY86). Develop 5-year plan for coordinating the tri-service advanced threat simulator development.

MATRIX, Virginia, $51,549.45 (FY85). Provide technical analyses to determine Naval requirements for threat simulators.

SRS Technologies, Alabama, $207,000 (FY85). Provide for a survey of software, cataloging methodologies and hybrid simulation facilities.

Hughes Aircraft Company, California, $996,000 (FY86). Provide radar surrogate test support.

MSIC, Alabama, $1,105,000 (FY86). Provide threat support.

EWA, Alabama, $147,437 (FY86). Provide data base support.

Electronic Warfare Associates, California, $350,000 (FY86). Provide integrated EW test requirements.

To provide the actual date of action for each contract would require a significant data retrieval effort involving considerable manpower. However, if you find this data essential, we will provide it to you as soon as possible.

[CLERK'S NOTE.—End of questions submitted by Mr. Miller.]

Mr. DICKS. Thank you, Dr. Navarro. We appreciate your testimony.

Dr. NAVARRO. Thank you.

WEDNESDAY, APRIL 9, 1986.

OFFICE OF THE DIRECTOR FOR OPERATIONAL TEST & EVALUATION

WITNESS

JOHN E. KRINGS, DIRECTOR, OPERATIONAL TEST AND EVALUATION

INTRODUCTORY REMARKS

Mr. DICKS. Mr. Krings, nice to have you here. Why don't you go ahead and give us a report on your independent operation.

Mr. KRINGS. Thank you for the opportunity. This is——

Mr. DICKS. Sorry it's so late.

Mr. KRINGS. That is quite all right. We welcome the opportunity to be here.

With your permission, I would like to submit my statement for the record.

Mr. DICKS. Your complete statement will be submitted for the record. You can summarize in any way you feel comfortable.

Mr. KRINGS. I will just do a brief summary of what we do and try to keep it to a couple of minutes so we can spend more time on your questions.

Mr. DICKS. Good.

OPENING STATEMENT OF MR. KRINGS

Mr. KRINGS. Congress, in its divine wisdom, enacted Public Law 98-94 in 1983 to create an ASD level job in the Department of Defense focusing on independent operational testing. In that position, I report directly to the Secretary of Defense and to the Congress—basically, the four committees of the Congress, your committee—House Appropriations—the Senate Appropriations and the two Armed Services Committees.

Military departments write the operational test plans. They execute the operational testing, and our primary job is to approve those tests to be sure they are adequate in terms of money, people, time and those things that contribute to the adequacy of an operational test plan.

Mr. DICKS. What was your background?

Mr. KRINGS. I have been an experimental test pilot for basically 30 years and an operational test pilot and fighter pilot and things like that.

Mr. DICKS. Were you in the active military?

Mr. KRINGS. Yes, active military for five years and in the reserve and guard for another seven, ten or twelve years in flying operations.

Mr. DICKS. What was your job before you took this one?

Mr. Krings. I was chief test pilot for McDonnell-Douglas Corporation.

Mr. Dicks. I have heard of them. Proceed.

Mr. Krings. We then basically approve the adequacy of the test plan in terms of facilities, equipment, money, the right kind of people, those things that one would look at to make sure that a test was adequate.

We have the opportunity to observe the testing while being done to ensure that the plan is being followed. Ultimately, we submit a report on this operational test. We submit basically two reports: an annual report, trying to express the status of those programs that are under test, and what we call a beyond low-rate initial production report, meaning that that particular system is eligible, if you will, to go from low-rate initial production into full-scale production.

At that time, we render a report to the four committees in the Congress and to the Secretary of Defense of our independent view of the success of the weapon system in achieving its operational requirements.

Mr. Dicks. How many people do you have on your staff?

Mr. Krings. Twenty-three total on the staff.

Mr. Dicks. Is that an adequate staff?

Mr. Krings. Not as we see testing changing no. It would have been adequate, except there is significant change in the way operational testing is being done, and it does in fact require more people as a result of that.

In this report, then, we independently give the Congress and the Secretary our evaluation of the operational effectiveness and capability and suitability of the particular weapon system being tested. We are responsible for all DoD operational test and evaluation policies, and in that respect, I am the principal person involved in that sort of activity.

The things that we are looking for in the operational test final condition are: it must be adequate, there has to be enough money and time and the right kind of people; it must be rigorous. We would like to approach the realism of combat if we could. We do the best we can to approach this so it will be realistic and the system will be evaluated as the user must ultimately use it against a threat postulated for the period of time the weapon system is to be fielded.

This represents a rather significant challenge, but nevertheless we can't build weapons for prior threats. The focus, of course, is on independence. We are authorized and do take advantage of going to observe all of these tests. We don't observe every one every day, but try to observe those that appear to be critical or those under which we might have questions as to how they might be executed.

We do our assessment and write our report. We try to do follow-up activity also, to ensure that our judgment and ultimately the user's judgment is the same. If it is not, we haven't done our job very well, so we try to follow the fielded systems and make certain that a 17-year-old kid in a tank doesn't find a problem that all the geniuses couldn't find in the first few years.

And there are opportunities in this follow-up to improve the way we test and improve the weapon system that is being fielded or any new weapon system. Since we have been in existence, we have had some measurable effect.

The document that Dr. Navarro mentioned called the Test and Evaluation Master Plan, or TEMP, is the agreed-upon plan for all testing from the inception of the weapon system until it is delivered. We find this tc be a very good vehicle to discipline the program. If it isn't in the test plan, the weapon system isn't expected to do it. The plan is a living device that lives through the life of the program and precludes a program from going off course and hopefully precludes the requirements creep, where halfway through the program they decide they will do more things. If that isn't in the test plan, it shouldn't be done, so we use that vehicle as a disciplining device and have made it a requirement to update it annually so that everybody knows what the purpose of the weapons system is and how it will be finally tested. If anybody has differences of opinion as to what it is supposed to do, that is an opportunity to voice it. We use the TEMP as a vehicle to discipline the program through its life.

It is an agreed-upon and open document allowing us to ensure that there isn't any reduction in capability or increase in capability without everybody agreeing that is the direction we want to go. It serves as an opportunity to update as the threat changes during the life of the program.

The operational test and evaluation plans which are again put together by the Services, we have had fairly significant effect on making them a little bit more rigorous in many cases and certainly a little more timely in many cases. There have been many cases in the past where tests have actually started without an agreement as to what the procedures or answer would be. So I think we have had a significant effect in that area.

Our observers have been to many tests, 14 or 15 tests this year, and their presence has an effect on the quality of the tests, no question about it. We have focused dramatically on threat upgrades, not killing old targets, not killing old threats, because certainly we don't need to pay a lot of money to kill Korean War threats. We are trying to focus on the testing, to ensure that electronic environment of the test represents the future period of time that that particular weapon system will be active in and trying to create the test facilities so they will be there when they are necessary.

Sometimes the threat environment is harder to build than the weapon system that you are building. As you know, there are very few operational test facilities. Historically, operational testing has been done on either development test facilities or on training facilities, and that may be the reason that we are sometimes very, very weak in the ability to create an operational environment to do a good test.

We are trying to focus more emphasis on operational test facilities that also can be used in other roles, because it is kind of the basis of our assessment that things shouldn't have a single role. Facilities have to be used for more things than one, and we are trying to make the community aware of the weaknesses and trying to focus in on improving that, and I think we are making inroads in that particular direction.

We have to identify system weaknesses. For example, three of our major reports during fiscal year 1985: The first was on the York gun system, the DIVAD. We reported on that, on the AHIP——

Mr. DICKS. Did you report on that before it was killed?

Mr. KRINGS. Yes. Our report went to the Secretary, and the Secretary, using our report and other information, made his judgment.

The AHIP was a case in which it was kind of a 50/50—actually it was a 30/70. It had three roles and, basically, it passed one role and the other two roles it didn't pass, so the production was limited to that particular role. Another test is being developed. We will see what the outcome of that one is.

Mr. DICKS. Did you say the Services develop the tests?

Mr. KRINGS. Yes.

Mr. DICKS. And you review them?

Mr. KRINGS. That is right. We approve them.

Mr. DICKS. You can send it back and tell them we don't think you have enough in this one and you should do the following?

Mr. KRINGS. Yes.

Mr. DICKS. How would you rate the Services on this? They tell us they have this great group of people that look over the weapon systems and that they are completely insulated. How do you rate them?

Mr. KRINGS. I wouldn't go quite that far.

Mr. DICKS. Why don't you do it Service by Service?

Mr. KRINGS. I would preface this by saying they are all changing as a result of having a person there in OSD to reinforce the testers. The Service testers themselves do a marvelous job. They are very capable. It is just that sometimes they get a lot of "help" as to how the tests should be constructed.

Mr. DICKS. From the program manager——

Mr. KRINGS. At least.

Mr. DICKS. And a few others?

Mr. KRINGS. Yes, dedicated advocates who want their system to be successful. I don't think there is ever any malice. It is just their view of life; therefore, from Service to Service there is a degree of insulation, but the insulation isn't quite what it should be. One can understand that in a bureacratic system.

Mr. DICKS. Are you able to hire your own people?

Mr. KRINGS. I inherited a few people, as the office existed before I was appointed. We have kept those people, and we have a mix, about half military and half civilian. We must have the military people; they understand the ball game.

Mr. DICKS. You have military people assigned to you?

Mr. KRINGS. Yes.

Mr. DICKS. Well, do they go back to the military after they get through with you?

Mr. KRINGS. Yes, they do. Quite truthfully——

Mr. DICKS. That bothers me a little bit.

Mr. KRINGS. I agree. It is a problem, no question about it, but it is a problem we have to deal with rather than eliminate. We have to learn how to do it as best we can because we have to have that expertise in our camp.

Mr. DICKS. Why can't you get retired military?

Mr. KRINGS. Because the pay rules are such that the retiree gives up a significant portion of his retirement. Anybody who would do that we probably wouldn't want. If he weren't smarter than that, he probably wouldn't do a very good job.

However, most of the people that we have from the military are for all practical purposes last-term colonels or equivalents, and a significant portion of them have become very insulated from Service pressure. They really have.

Mr. DICKS. Do you pick them?

Mr. KRINGS. I didn't pick all these people because most were there when I came, but subsequent ones, yes, I have and will.

Mr. DICKS. You have the right to pick who you want?

Mr. KRINGS. Absolutely, yes.

Mr. DICKS. Was it your person who raised the criticism on the Bradley?

Mr. KRINGS. No, that is another office.

Mr. DICKS. Which office is that?

Mr. KRINGS. That is the Under Secretary of Defense for Research and Engineering, Test and Evaluation.

Mr. DICKS. Mr. Hicks' office?

Mr. KRINGS. It is actually in Dr. Navarro's office. They own the joint tests, of which LIVE FIRE is a part. We pick our people. They generally have a pretty intensive testing background, many times with the Service that is actually accomplishing the test, so it is a two-edged sword. Get somebody who knows how they work and has done it before, and you try to create an atmosphere of independency so that they won't be pressured by the Service.

So far we have been very good at it. I suspect there will be cases where we get people with greater allegiance to their Service than to this cause, and we can take care of that.

That is the kind of military people we have, and then we have a civilian staff of about the same number of people who are more technically oriented people who can look at the technical challenges in the testing, the electronics, weapon system, et cetera, if it is a C-3I program.

We have written three annual reports. This year we will have classified and unclassified versions. Your committee got the classified version, and we hope to provide the unclassified version soon, because it is desperately needed. It takes time to get everybody to agree what is classified and what isn't. We try to get as much of our reports and evaluations out in an unclassified form as quickly as we can.

In Service OT&E budgeting, we are very concerned about how the Services look at their operational test budgeting in terms of facilities, et cetera. Since I am a member of the DSARC and the DRB, in the DRB process, we can revisit those areas that a Service has elected not to budget properly for testing.

In that particular role, I represent all the T&E community, development and operational. It is a chance to get in there and convince the Services to dedicate the proper funds to testing. I am a member of the DSARC and the DRB, and I go to all the Secretary's program reviews.

Mr. DICKS. How are you treated?

Mr. KRINGS. Very, very well. The basis for it really is that our most significant supporter, including all those up here who created us, is the Secretary of Defense. He is a very, very open, staunch supporter of our activity. He uses us not unlike the people on the Hill would. He wants to get a second opinion, and he asks in many cases for us to produce for him a second opinion during the progress and at the end of these programs. It has a significant effect on the candor with which some of the Services report some of their activities, because now he knows what is going on.

It has been effective, no question about it. And I think the Secretary has utilized us as much as anybody has. So the bottom line of our operation is, when we were created there was no organization to begin with. The rules have been created since we have been there, and we didn't have history to inherit.

Mr. DICKS. Were you recruited or did you seek the job?

Mr. KRINGS. It was suggested that they might be amenable to me. I had just come to Washington and some friends of mine in the Service wanted to make sure they got somebody who understood. I was offered the job. After talking with others it sounded like a good thing to do.

Mr. DICKS. Who interviewed you?

Mr. KRINGS. Actually, Dick DeLauer, who was not exactly thrilled about the creation.

Mr. DICKS. No, he thought this was the worst, stupidest idea he had ever heard of. He said, we don't need any more of those people over there.

Mr. KRINGS. I think that had a dramatic effect on creating the organization.

Mr. DICKS. Well, Dick did make a contribution.

Mr. KRINGS. Before he left he was one of the people that helped convince me that this was a good thing to do, along with Mr. Taft and Mr. Weinberger and a few people on the Hill, including Senator Goldwater, whom I have known over the years because he is an aviation fan as well.

Mr. DICKS. You submit your budget independently?

Mr. KRINGS. Yes.

Mr. DICKS. Directly to the Congress?

Mr. KRINGS. Yes.

Mr. DICKS. To the authorizing committee and then to the appropriations committees?

Mr. KRINGS. Yes, we have our own line in the President's budget.

Mr. DICKS. What have you requested for this year?

Mr. KRINGS. The fiscal year 1987 request is $11.3 million.

Mr. DICKS. Could you describe how that money would be used?

Mr. KRINGS. I certainly can. We would break it down functionally. The operational test and evaluation, which is done on weapon systems that are being acquired, is done throughout the life of the acquisition program. It consumes in the neighborhood of about $4 million.

We have one joint operational test program, as compared to the four or five that the other group has. Ours is called the Joint Chemical Program, and it is basically to determine what the response characteristics are of the U.S. forces in terms of chemical warfare—how we would retaliate, the mechanism by which we would retaliate seeing if there is one and if it works, and if you turned the switch would everybody be able to do everything.

Mr. Dicks. How did you pick that?

Mr. Krings. In the process before I came, there was a method whereby Service candidates for joint testing were reviewed and then they were evaluated and selected. That particular one was selected in this candidacy selection process that existed before I came.

Mr. Dicks. That dominates a lot of your time, effort and energy, doesn't it?

Mr. Krings. Yes, but it is separately funded and separately staffed from my group of people. The people that I described earlier are not involved in that.

Mr. Dicks. I could see them designating a lot of things for you to do that would eat up your entire time and schedule.

Mr. Krings. We have limited that test to a finite period of time and dollars. The policy that we have on joint testing is we want a "contract" on how you are going to use the answer before we fund the test. It is not a study; it is an answer, and it has to have an effect. Otherwise, we don't want to spend the money.

So we have reduced that effort slightly in the recent years—past year, I should say. We are going to be relatively selective about any new ones, as they have to have a justifiable existence. So that consumes about $4.6 million both in the facilities and equipment to do the test as well as the technical support that is required for it.

So between the two, the operational testing of weapon systems being acquired and the joint operational test eat up almost $8.8 million. We have $2.5 million in what we call special projects. In that particular area, we are trying to develop new techniques for operational testing and also to get an institutional system that will ensure that the facilities and equipment that are required for operational testing will meet those particular requirements when the time comes, so that we have a scheme of getting facilities, getting support, getting threats, et cetera, to match the weapon systems that are being bought so that those facilities will be available and in place when testing comes.

That is where most of our money is consumed, and a great portion of it goes to outside contract support. That outside contract support is from a number of companies—IDA, BDM, companies like that. The goal there is for them to process data. If we have an analytical problem, they would exercise the analytical data under a plan that we had to do the analysis. They do the exercise of the analysis, then we do the judgment at the end.

Mr. Dicks. All right.

Mr. Krings. They are not involved in creating the basis for the analysis nor are they involved in making the judgment at the end. They do the number crunching work basically in between, and they have a good analytical team to be sure it is done professionally and rigorously. That is where most of our outside expenditures go.

[The statement of Mr. Krings follows:]

STATEMENT OF THE DIRECTOR, OPERATIONAL TEST AND EVALUATION

Mr. Chairman, Mr. McDade, members of the subcommittee--I am delighted to be with you today. I have been looking forward to this opportunity to give you a progress report on the work of my office since my confirmation last April and to share with you my ideas on the role of operational testing in the defense acquisition process. Thank you for asking me to appear before you.

In its short lifetime, the office of the Director, Operational Test and Evaluation (DOT&E), has had a significant positive impact on the acquisition process of the Department of Defense (DoD), to the benefit of the taxpayers and our forces in the field. We are doing the job Congress called for, and I believe we are doing it well.

Simply stated, that job is to apply rigorous, independent oversight to operational test (OT) matters to help keep the DoD acquisition process focused on its overriding goal: fielding cost-effective weapon systems and equipment that work and are available when and where they are needed.

I am convinced that this requires the earliest possible OT involvement in the process. It also requires realistic OT. This in turn requires realistic representations of the threats and environments which systems and equipment will encounter when they are fielded. None of this is possible without long-range planning for OT and OT resources and the necessary budgetary and institutional support to make them available when needed.

Test and Evaluation Planning Oversight

DOT&E is using its authority under the law to approve and disapprove Test and Evaluation Master Plans (TEMPs) and OT plans to assure that OT concerns and requirements are incorporated early in the life of new programs. We are also reviewing TEMPs and test plans for existing programs to assure that they, too, adequately address OT requirements.

During FY 1985 DOT&E reviewed TEMPs and detailed operational test plans for many programs, including:

Ground Launched Cruise Missile (GLCM)
Low Altitude Navigation and Targeting

Infrared System for
  Night (LANTIRN)
Army Helicopter Improvement Program (AHIP)
ALQ-131 Block II Jamming Pod
M1E1 Service Ammunition
DIVAD (Sgt York--four separate iterations)
Joint U.S. Chemical Warfare Retaliatory
Capability Test
  (JCHEM)
T-46A Next Generation Trainer
Joint Surveillance and Target Attack
Reconnaissance

  System (JSTARS)
Close-In Weapon System (CIWS)
Advanced Tactical Fighter (ATF)
Pershing II
Mk-50 Torpedo
DDG-51 Guided Missile Destroyer
Mark XV Identification Friend or Foe System
Carrier Helicopter
T-45TS Trainer
LSD-41 Class Landing Ship
Inter-Service/Agency Automated Message
Processing
  Exchange (I-S/A AMPE)
V-22 (JVX)
F/A-18
SSN-21 Class Attack Submarine
Landing Craft Air Cushion (LCAC)
AN/SPY-1B Radar (AEGIS)
HARPOON
Special Operations Force (SOF)
Long-range Rotary Wing Mission System
E-2C Upgrade Program

These reviews, a number of which included several iterations of the same program, resulted in 17 approval actions and 16 comment, change, or disapproval actions.

Two areas receive particular attention during DOT&E approval reviews. The first is test-resource planning: Are they planning for everything they need for realistic tests? Will the necessary resources be ready and available on time?

The second is threat planning: Do the plans call for testing against system IOC (initial operating capability) threats? This is critical to our success in acquiring systems and equipment that

will be effective against the threats they will face when they are fielded.

Under the DOT&E plan-approval authority and in cooperation with the Under Secretary of Defense for Research and Engineering (USDR&E), I have established a policy of requiring regular TEMP updates. The purpose of these updates,

which must be submitted to me and to the USDR&E for review and approval, is to assure that factors bearing on the success of a program (e.g., the discovery of a new, more potent IOC threat; requirement or concept refinements; technical or funding problems) are being taken into account and that test-resource planning and acquisition are proceeding satisfactorily.

Secretary Weinberger has been apprised of this TEMP update and review and approval policy, which is set forth formally in the newly revised DoD Directive 5000.3, "Test and Evaluation." Under the new "rules of the road," no program may proceed to a Defense Systems Acquisition Review Council (DSARC) or Service SARC review unless it has an up-to-date TEMP approved by DOT&E and USDR&E.

Operational Test Resource Management and Investment

When the Services' independent operational test and evaluation (OT&E) organizations were formed in the early to middle 1970s, the implementation philosophy was to provide for independence without duplicating existing test resources. Consequently, the management and ownership of test resources has, in the main, remained with the Service R&D management organizations and their developmental test centers. This management philosophy is a logical extension of the DoD budget principle that all RDT&E-related efforts should be funded from the RDT&E appropriation. Central management of test and evaluation (T&E) resources by the Service R&D management organizations facilitates the implementation of this principle and minimizes the possibility of duplication within a Service. Moreover, it does not place an operational test organization (OTO) in competition for resources with or make it subordinate to the Service R&D management organization, thus preserving OTO independence.

The Service OTO is, therefore, a user of available test resources, as are the developmental testers. Day-to-day resource management is, then, a question of scheduling. Since the Services generally handle scheduling problems very well and initial OT&E (IOT&E) is usually accorded a priority over other competing uses, conflicts are few.

Long-Range Planning (15-20 years). This is another matter. Continuing improvement in test realism requires a rigorous, comprehensive, long-range T&E planning process. New test capabilities required for the late 1990s and early twenty-first century should be included in Service test-capabilities-development lines now. While some T&E resource planning is carried out within the Services with varying degrees of thoroughness, the OTOs are not involved, and what planning there is, is rarely long-range. I expect a DOT&E review of Service test resource planning procedures to be concluded by the end of the second quarter of FY 1986, whereupon I will issue appropriate direction to encourage long-range OT&E resource planning by the Services.

Day-to-Day Management. In execution, the RDT&E appropriation funds the direct costs of both IOT&E and developmental T&E (DT&E). However, follow-on OT&E, which is conducted subsequent to acceptance of a system for operational use (i.e., after IOT&E), is funded by the O&M appropriation for direct costs and by the procurement appropriation for investment expenses (e.g., for test articles). This division of funding derives from the aforementioned budget principle for RDT&E funding. IOT&E contributes directly to the development of the weapon system. Accordingly, test articles and other support costs of IOT&E are funded from the RDT&E appropriation. Pilot production costs for end-items not accepted for operational use, but necessary to provide representative test articles, are also funded from RDT&E. Conversely, equipment, munitions, and items that are already in routine production are provided from stock without reimbursement from RDT&E.

Implementation of the above guidelines varies somewhat from Service to Service. For example, the Air Force and the Navy both require direct IOT&E costs to be funded in a weapon system's RDT&E program element (PE). The Army centrally funds IOT&E costs in a single RDT&E PE, which contains many project lines; however, this funding may be supplemented from a weapon system PE if the need arises.

Cost of OT&E. A discussion of resource management would not be complete without addressing costs. Service cost reporting for IOT&E differs considerably both in types of costs (e.g., tanks versus ships versus aircraft) and rigorousness of accounting. For example, as I indicated above, the cost of resources that are provided for OT&E without reimbursement is not assigned or prorated to IOT&E by any Service. In addition, items that support both DT&E and IOT&E are usually charged to DT&E as the first user. In any event, costs cannot easily be normalized or compared among the Services. Further, as the results of an Air Force survey indicate, recorded IOT&E costs are such a small percentage of the total development cost of a weapon system (generally less than 1-2 percent) that they are not an issue within the Service. Representatives of other Service OTOs have indicated that, intuitively, they would expect to find similar results.

In isolation, IOT&E costs (funding), do not constitute a useful management indicator. However, the broader view of resources required to support an IOT&E program (e.g., flying hours, steaming time, TDY manpower, rounds of ammunition) in the context of an approved TEMP or test plan, is useful. New direction requires annual updating of TEMP resource annexes regardless of any change in the plan content. The resource annex (a fiscal year spread sheet) will become a key indicator of potential OT&E program changes. For example, resource changes frequently occur outside the acquisition and T&E planning processes. Therefore, a change in available or planned T&E resources may actually precede a T&E plan content change, indicating the need for a review of the plan.

I consider oversight of the resources supporting OT&E programs to be an effective management indicator that will be of great value in evaluating the adequacy of Service OT&E plans. To facilitate this, the OT data base being designed for DOT&E will include analytical algorithms that will make possible meaningful comparison of OT&E program resources from one year to the next.

OT&E of Space Systems. The advent of the Strategic Defense Initiative and the growing importance of manned and unmanned space operations, both military and civil, mandate a more intensive role for OT&E in the acquisition of space operating systems. Consequently, DOT&E has undertaken two initiatives. First, a study has been commissioned to examine current T&E methodology for space systems and to postulate new, more active OT&E involvement. Second, USDR&E (lead) and DOT&E, with the participation of all interested DoD and non-DoD agencies, are conducting a joint review of the requirements for testing capabilities (DT&E and OT&E) to support space-systems acquisition. The objective is to have specific recommendations for OT&E methodology changes and a DoD space-test baseline requirements definition ready for the FY 1988 budget.

Operational Test Resource Investment Strategy. My office also has underway a detailed survey of existing test resources and capabilities which support OT. It is my objective to clearly identify the strengths and weaknesses of the nation's capability to conduct OT. This will provide the basis for recommendations I will make later this year to the Secretary and the Congress for a equitable DoD test-investment strategy to improve our ability to do effective operational testing.

Embodied in this investment strategy will be a balance among efficiency, effectiveness, and operational realism. Antiquated facilities and capabilities will be retired, new approaches and methodologies for testing will be sought out, and options for combining Service capabilities and eliminating unnecessary duplication to achieve a better overall DoD capability will be examined. Nothing is beyond improvement, and imaginative, innovative approaches will be critical to the success of this effort.

Early OT Involvement

As I noted at the outset of my remarks, the earliest possible involvement of the OT community in the acquisition process is vital. Operational testing is more and more becoming a matter of forecasting. The traditional, or "final exam," approach of waiting for a production-representative item and operationally testing it just prior to going into production is today not usually sufficient, particularly for highly concurrent programs. In the main, this approach serves to identify the system deficiencies that will either carry forward into production or result in cancellation of the program.

The "down in the dirt" test, fix, test approach is not adequate either, because it tends to exclude new technology and unacceptably extend the acquisition process--and may ultimately result in what I call government-certified antiques. Certainly, a final phase of down-in-the-dirt OT is required to verify operational effectiveness and suitability, but today and in the future this is and will be but the last in a series of OT assessments.

Thus it is essential to forecast, to make assessments of operational effectiveness and suitability from the onset of an acquisition program and continually throughout its life. This is extremely difficult, but I know from long personal experience that it can and must be done. Truly candid projections of operational utility can be made with very high confidence through sophisticated simulation, combined operational and developmental testing, and fair, disciplined, timely, and independent evaluation and reporting by this office and the Service OT agencies.

Another element of early OT involvement is a new emphasis on OT&E participation in planning and evaluation activities prior to a program's Milestone II, or full-scale development, review point. To facilitate this, the requirements of DoDD 5000.3 and DoD Instruction 5000.2, "Major System Acquisition Procedures," for a program briefing of the Deputy Under Secretary of Defense for Research and Engineering (Development Test and Evaluation)--formerly DDT&E--at least three weeks before Milestone I and II reviews have been modified to require joint briefings hosted by my office and DUSDR&E(DT&E). These briefings will serve to help my office fully evaluate the adequacy of OT&E plans and assess the results of early OT.

My intent in laying special emphasis on early involvement of the OT&E community is to benefit--not hinder or disrupt--engineering development. It is my firm conviction that such involvement can go a long way toward avoiding future "DIVAD experiences." Along with continuous developmental-test community involvement, it will be a significant aid in identifying potential operational effectiveness and suitability pitfalls for correction long before they become insurmountable. This in turn can prevent expenditures of billions of dollars and years of effort only to have a system flunk its final exam--leaving critical user requirements unfulfilled for still more years to come.

OT Follow-Up

At the other end of the acquisition continuum, DOT&E is seeking to enhance OT follow-up after systems and equipment have been fielded. The purpose of these follow-ups is twofold. First, they will give us the basis for charting ways to improve the process of correcting OT-identified deficiencies during production and after delivery to the user. Second, by learning what deficiencies users have discovered in their "real world" experience with fielded systems and equipment, we can improve the way we do OT.

DOT&E Program Oversight

Title 10, Section 136a, U.S. Code requires DOT&E oversight of all major defense acquisition programs, as defined in Section 136a(a)(2)(B) and Section 139a(a)(1). Currently, there are more than 110 such programs. With the addition of non-major programs, DOT&E has oversight responsibility for more than 150 acquisition programs. During FY 1985, many program oversight activities took place.

I have already covered our TEMP and OT-plan approval review activities and initiatives. In addition, site visits were conducted for the following programs:

Tomahawk Sea Launched Cruise Missile (SLCM)
DIVAD
MAVERICK
LANTIRN
M1A1 Tank
LCAC
Joint Logistics Over the Shore (JLOTS) Joint Test
Standard Missile-II (SM-II)
B-1B
AV-8B Harrier
CH-47 Helicopter refueling tests
AN/SPY-1B
AHIP
Joint Tactical Information Distribution System (JTIDS)

Including repeat visits, over 35 program-related site visits were conducted.

More than 13 other visits were made to conferences (Targets and Remotely Piloted Vehicles and the Crossbow-S Threat Simulator Review), Service independent operational test and evaluation organization (AFOTEC, COMOPTEVFOR, MCOTEA, and OTEA), and selected test centers (Aberdeen Proving Grounds, the Air Force Flight Test Center, the Army Combat Development Experiment Center, and the Eglin Air Force Base Air-to-Ground Ranges).

DOT&E was represented at more than 13 DSARC or other similar program reviews, including:

Carrier Helicopter
Navstar GPS User Equipment
F-18
High Frequency Anti-Jam System
SSN-21 Attack Submarine
Automated Message Processing Exchange
WWMCCS Information System
AMRAAM
AHIP
SUBACS
ATARS
Air Defense Aircraft

During FY 1985, three programs monitored by DOT&E--TOMAHAWK, AHIP, and DIVAD--reached the point at which a decision on proceeding beyond low-rate initial production (LRIP) was required. As we entered the current fiscal year, the Marine Corps' AV-8B Harrier program also reached the LRIP decision point. Assessments of all four programs were reported to the Secretary of Defense and the Congress. The TOMAHAWK assessment was favorable and the program is proceeding. The DIVAD assessment was unfavorable, and the Secretary of Defense terminated the program. The AHIP assessment confirmed the effectiveness and suitability of the system in one of the three roles for which it was developed. The Secretary approved production for only that role. Our AV-8B assessment was favorable. The Secretary of the Navy--to whom had been delegated beyond-LRIP decision authority for the program-- approved production of the aircraft.

FY 1987 Budget Initiatives

During the FY 1987 DoD program review (issue cycle), DOT&E successfully argued six T&E related issues: the Cruise Missile Mission Control Aircraft (CMMCA), the Global Positioning System/Time Space Positioning Instrumentation (GPS/TSPI), Weapons Systems Data Protection (WSDP), the Electromagnetic Pulse/Design Verification Test (EMP/DVT), the Air Force Electronic Warfare Evaluation Simulator (AFEWES), and RDT&E funding for the activities of our own office.

CMMCA (PE 64755F). Current DoD cruise missile T&E support capabilities are resource constrained. Depending on the sortie length and purpose, a cruise missile T&E mission may require a fleet of from 8 to 17 aircraft to provide chase, telemetry, tanker support, and positive command and control. The current cruise missile test support fleet has only a visual (daylight, clear weather) capability, which limits it to less than 30 productive missions per year. Projections indicate more than 80 cruise missile T&E missions per year will be required in FY 1987 and beyond.

After extensive study by the Air Force and DoD, it was concluded that an all-in-one (radar tracking, telemetry, missile health analysis, command and control) aircraft was the solution. The studies went so far as to consider use of AWACS (E-3A) and F-15 aircraft as an alternative. This alternative was dropped since it would require extensive aircraft modification and the use of aircraft that were too critical to operational readiness and national security.

The FY 1987 Air Force POM contained no CMMCA funding. Consequently, DOT&E supported the modification of two 707s (C-18s) already in the Air Force inventory to a CMMCA configuration. The two CMMCAs will provide sufficient additional capability to support the projected annual 80 mission workload and will provide an all-weather capability for more efficient use of test ranges, more representative routes, and decreased per-mission cost. Although this requirement had been foreseen by the Air Force over three years ago, it took the presence of DOT&E to bring enough attention to bear. Unfortunately, because of the delay, the CMMCA capability will not be available until 1989 or 1990. Nevertheless, DOT&E successfully argued that funds should be added to the Air Force budget for CMMCA.

GPS/TSPI (PE 64755F). The Air Force is the lead Service for developing GPS-based instrumentation sets and interfaces. GPS/TSPI is more cost effective (lower installation cost) and more accurate than current ground based systems and has an inherent mobile capability (satellite based) that will allow testing over more representative terrain. GPS/TSPI, like CMMCA, will provide joint Service support. The development effort was only partially funded in the Air Force POM. DOT&E successfully argued that funding should be added to the Air Force budget to complete the development program.

WSDP (PEs 65804A and 64755F). The Secretary of Defense determined that significant advantage accrued to the Soviet Union due to unprotected weapons design and test data information. The Services were directed to plan and budget for the capabilities necessary to protect weapon system data in the FY 1987 POM. The Navy prepared a plan and funded its protection activities. Although both the Army and the Air Force prepared plans, the Army only partially funded its plan and the Air Force budgeted no funds. DOT&E successfully argued that both the Army and the Air Force should reprogram internally to provide the requisite funding for their data protection plans.

EMP/DVT (PE 64711F). The B-1B is the first strategic aircraft produced with nuclear hardness (EMP) criteria included in its baseline design. The EMP test required to verify the hardness of this system design and to establish the baseline for this life-cycle hardness maintenance and surveillance program was not included in the Air Force 1987 POM submission. DOT&E argued for and the Air Force was directed to include EMP/DVT funding in the Air Force budget.

AFEWES (PE 64738F). The AFEWES is a sophisticated simulator designed to provide threat representations for evaluation of various U.S. and foreign EW systems. Because of the Air Force's continued use of the AFEWES funding line as a reprogramming source for EW technology efforts, much-needed upgrades of AFEWES capabilities have been neglected for some time. As is the case with CMMCA and GPS/TSPI, AFEWES provides joint Service support. In view of this and the clear need to improve the facility's capabilities, DOT&E argued that funding should be added to the Air Force budget for an aggressive AFEWES revitalization effort. As a result, the Air Force was directed to include such funding in its FY 1987 budget.

RDT&E Funding for DOT&E (PE 65118D). Title 10, Section 136a, U.S. Code requires DOT&E to assess the adequacy of OT&E and the operational effectiveness and suitability of weapon systems, and report these assessments to the Committees on Armed Services and Appropriations of the House and Senate before decisions may be made for weapon systems to proceed beyond LRIP. The OT&E conducted and assessed for the required report is IOT&E. The costs of IOT&E are funded from the RDT&E appropriation. DOT&E argued successfully that, in order to carry out the statutory responsibilities of the office and not be unnecessarily constrained in its initiatives to promote test realism, DOT&E expenses should be funded in RDT&E rather than the current (FY 1985 and FY 1986) O&M appropriation.

Our FY 1987 request is $11.3 million. The specifics are detailed in the accompanying charts, which include comparisons with FYs 1985, 1986, and 1988.

DOT&E Staffing and Organization

Last summer, I asked the Secretary to approve an increase in the size of the DOT&E staff. Although limited in what he could do by congressionally mandated constraints on the size of the Office of the Secretary of Defense staff organization, he authorized an increase from 16 to 23 positions (including two temporary military-overstrength positions) for my office. Nineteen positions are now filled, and I expect to have the office fully staffed by the end of March. The organization of DOT&E is depicted in the accompanying chart.

We have obtained contract technical and analytical support to assist the office in the review of plans, the analysis of test requirements, scenarios, and threats, the survey of test results, and the development of an OT data base and associated analytical tools. This technical and analytical assistance is needed in areas in which DOT&E cannot maintain the requisite expertise in house. Currently, we have support contracts with the BDM Corporation, the Institute for Defense Analyses, and Electronic Warfare Associates. Of course, my staff and I make the final judgments, which we base upon the best available data from all sources.

In addition, it is not unreasonable to think of the 12,000-plus men and women of the independent Service OT and joint-test organizations as being "staffed" to DOT&E. They develop the test plans and programs, conduct OT, and gather and evaluate the data. They report to us directly through their respective Service secretaries and chiefs, and my staff and I maintain an increasingly closer working relationship with them.

To facilitate this, and to promote cooperation among the Services, my office, the office of the USDR&E, and other DoD organizations, I have undertaken a number of initiatives. Among these is a continuing series of informal meetings, taking place approximately quarterly, to provide a forum for the exchange of ideas and concerns with the commanders of the Service independent OT agencies. (The most recent took place last month in Norfolk.) We have also established liaison with the test-range commanders through the Range Commanders Council, and last fall, my office hosted a meeting of Service, DoD, and contractor representatives at which the Services presented briefings on their approaches to test-resource planning. In mid-June, DOT&E and USDR&E will host a senior-level test and evaluation policy symposium to continue the process.

Conclusion

Since taking office last spring, I have been pleased to discover in practice how generally well drawn the law is that established DOT&E. Almost without exception, the specific direction and the flexibility built into it give me both the authority and the independence I need to carry out my responsibilities. In addition, the support and unequivocal respect for the independence of this office which I have received from Secretary Weinberger and at the highest levels throughout DoD and the Services have been both gratifying and helpful.

In this connection, I cannot emphasize enough how important it is to maintain the independency of my office and our direct access to both the Secretary and the Congress. As the Congress recognized when it established DOT&E, oversight of operational test and evaluation must be conducted in an objective, rigorous, and fair manner--uninfluenced by any interest in the success or failure of the programs being assessed. It is critical that those who must make the decisions to proceed or not to proceed with major acquisitions have the benefit of the insights, advice, and counsel of an independent evaluator--unfiltered by any requirement to report through another official or layers of bureaucracy.

Finally, I would like to note that we have established a good, effective, and mutually beneficial working relationship with the General Accounting Office (GAO). I know that we have learned a great deal from GAO's very professional staff, and I believe we have given them good reason to have confidence in our professionalism and judgment.

In sum, we are indeed doing the job and doing it well--and we are getting better at it with each passing day. Continuation of this sustained improvement of DOT&E's contribution to national defense will be assured so long as the strong support of Congress, the Secretary, and the operational test and evaluation community--the men and women who do the real OT job--continues as it has to date. To merit this, we must earn it. We will continue to do our best to do so.

Thank you, Mr. Chairman. I would be happy to answer any questions that you and the members of the subcommittee may have.

FY 1987 PRESIDENT'S BUDGET

APPROPRIATION 460: DIRECTOR, OPERATIONAL TEST AND EVALUATION

($ IN THOUSANDS)

DOT&E

PROGRAM ELEMENT	FY 1985 (ACTUAL)	FY 1986 (ESTIMATE)	FY 1987 (REQUEST)	FY 1988 (ESTIMATE)
65118D	8,465*	10,649*	11,300	11,735

*O&M, DEFENSE AGENCIES

FY 1987 PRESIDENT'S BUDGET
DIRECTOR, OPERATIONAL TEST AND EVALUATION
FUNCTIONAL SUMMARY
($ IN THOUSANDS)

DOT&E

	FY 1985	FY 1986	FY 1987	FY 1988
IOT&E SUPPORT	1,390	3,975	4,206	4,518
JOT&E SUPPORT	7,075	5,074	4,594	4,217
SPECIAL PROJECTS	--	1,600	2,500	3,000
TOTAL	8,465	10,649	11,300	11,735

FY 1987 PRESIDENT'S BUDGET

DIRECTOR, OPERATIONAL TEST AND EVALUATION

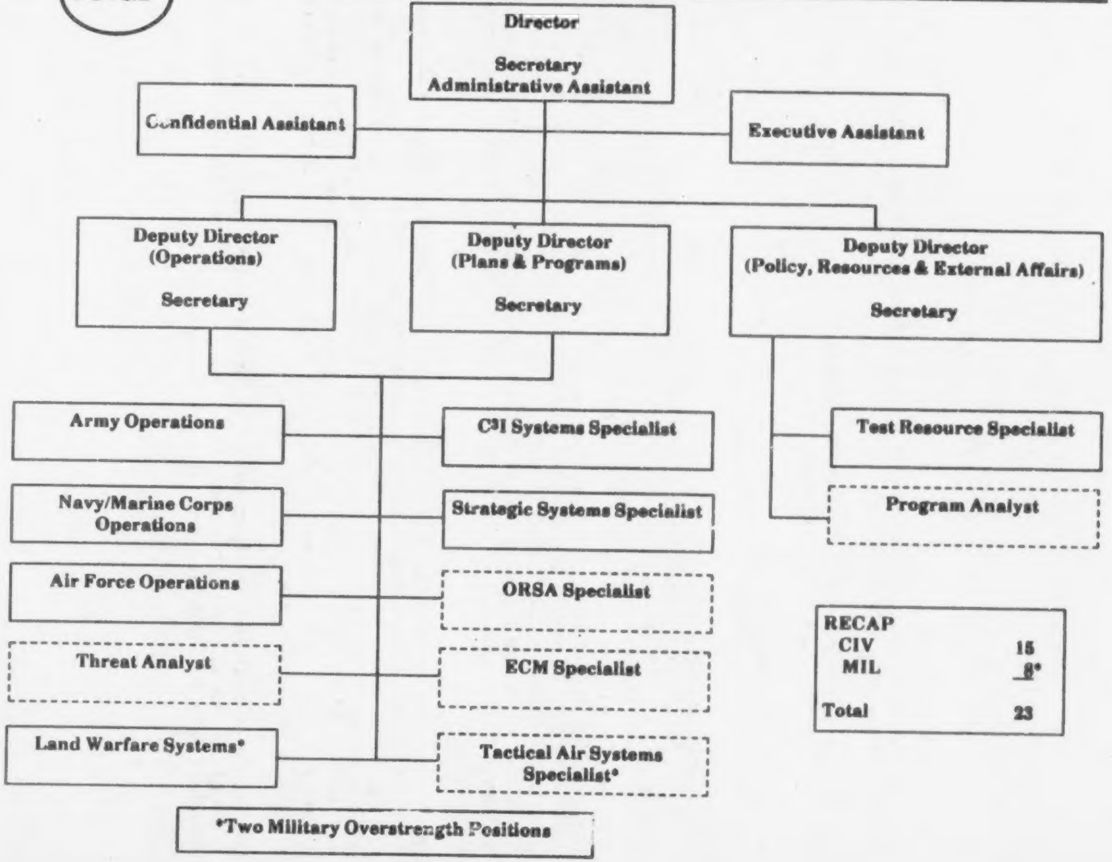
COMMODITY SUMMARY

($ IN THOUSANDS)

DOT&E

	FY 1985	FY 1986	FY 1987	FY 1988
CONTRACT SUPPORT	3,682	6,625	6,856	4,918
(JOINT TEST)	(2,292)	(2,650)	(2,650)	(400)
JOT&E SUPPORT	4,783	2,424	1,944	3,817
SPECIAL ANALYSIS (EW)		590	1,900	2,100
TEST CAPABILITIES		1,010	600	900
TOTAL	8,465	10,649	11,300	11,735

DIRECTOR OPERATIONAL TEST AND EVALUATION


DOT&E
Director
Secretary
Administrative Assistant
Confidential Assistant
Executive Assistant
Deputy Director
(Operations)
Secretary
Deputy Director
(Plans & Programs)
Secretary
Deputy Director
(Policy, Resources & External Affairs)
Secretary
Army Operations
C³I Systems Specialist
Test Resource Specialist
Navy/Marine Corps Operations
Strategic Systems Specialist
Program Analyst
Air Force Operations
ORSA Specialist
RECAP
CIV 15
MIL 8*
Total 23
Threat Analyst
ECM Specialist
Land Warfare Systems*
Tactical Air Systems Specialist*
*Two Military Overstrength Positions

THE HONORABLE JOHN E. KRINGS

DIRECTOR, OPERATIONAL TEST AND EVALUATION

The Honorable John E. (Jack) Krings is the first director of Operational, Test and Evaluation (OT&E), Office of the Secretary of Defense. He has the unique role of serving as the independent evaluator of operational testing for both the Secretary of Defense and the United States Congress, and holds a rank equivalent to that of Assistant Secretary of Defense.

Mr. Krings was born April 2, 1930, in Pittsburgh, Pennsylvania. He graduated from Central Catholic High School, attended Duquesne University, and graduated from Louisiana State University in 1952 with a Bachelor of Science degree in chemistry and physics. Upon graduation, he was commissioned in the U.S. Air Force and flew fighters in Korea and Japan for four years.

He joined the McDonnell Douglas Corporation in 1956, flying fighters in the Missouri Air National Guard and test flying F-3H Demons and F-101 Voodoos at McDonnell. In 1960, he attended the U.S. Navy Test Pilot School at Patuxent River, Maryland, and after being recalled for a period of active duty in France with the Air National Guard, he returned to St. Louis to participate in the testing of all models of the F-4 Phantom during the development program for that aircraft. He then participated in the design and development of the F-15 Eagle. He was an early test pilot in all phases of the F-15 development program and flew the spin tests in the Eagle--for which he received the 1975 "Test Pilot of the Year" Award from the Society of Experimental Test Pilots. In November 1978, he flew the F-18 Hornet on its first flight.

Mr. Krings was the Director of Flight Operations and Chief Test Pilot for McDonnell Douglas for seven years, continuing his active test flying of F-15's and F-18's until October 1983, when he moved to Washington, D.C., to become the Director of the McDonnell Douglas Corporation Navy and Marine Corps Programs. In 1985, he retired from McDonnell Douglas to accept appointment by President Reagan as the Director of Operational Test and Evaluation. Mr. Krings was confirmed as Director, OT&E, by the U.S. Senate on April 16, 1985.

Mr. Krings is married to the former Joan L. Christian of St. Louis, Missouri. He has a daughter, Karen, and three sons, Kent, Kirk and Kerry. Mrs. Krings has a daughter, Mrs. Ann Goodhue, and two sons, Matt and Roy.

DSARC PROCESS EFFECTIVENESS

Mr. DICKS. The Inspector General has issued a series of reports which indicate that the DSARC process is not working effectively. The lack of required documentation for DSARC reviews often includes the test and evaluation master plan which is the primary description of proposed testing and the resources needed to carry out that testing plan.

What is your opinion of the need to include controls over the DSARC process as it relates to operational testing?

Mr. KRINGS. We agree with them 100 percent, and we have enacted some fairly significant controls in the very recent past. Since I have been in, the Secretary agreed with me that without a test and evaluation master plan approved by OSD—and it is approved both by our office and by the USDRE—you don't go to a DSARC. If it is outstanding and not approved, we recommend "No DSARC." Quite truthfully, we have not had to do it yet, because the impact of that possibility has been fairly effective—that we'll just say, well, cancel the DSARC if you don't have it up to date.

The Secretary agrees with that and the Deputy Secretary agrees with it. That is a primary requirement to get into each one of these DSARCs. So we use the TEMP again as a disciplining function. That particular problem is overcome.

Now, there are lots of other TEMPS that have to be updated, and there's a process whereby we in a most recent regulation require it to be done annually. So they don't tend to get as far behind as they used to.

OPERATIONAL TESTING OF SPACE ASSETS

Mr. DICKS. The most rapidly increasing items in the Defense RDT&E budget involve space systems and technology, led by SDI, of course. Your office has begun two studies to address future operational test and evaluation needs in this area.

Would you elaborate on the scope of these studies and how you would anticipate using them in your future work?

Mr. KRINGS. First we have an agreement with SDI and through the Air Force operational test and evaluation organization, Albuquerque. They are putting together a comprehensive plan to do space operational testing with SDI equipment when it becomes available.

Mr. DICKS. With their test bed program?

Mr. KRINGS. Yes, but for the time being, while we are trying to create the test facilities to do this, the program that Dr. Navarro spoke about that we are involved in with him to try to put together an inventory of what is available now, what must be added and how it will be ultimately used, is a cooperative effort between USDRE and ourselves to ensure that both development and operational test requirements are being at least looked at at this time.

They are rather large, so we are just trying to get our hands around how big the requirement really is. In the meantime, we——

Mr. DICKS. This one could be huge. The variety of different technologies that are being talked about is just——

Mr. Krings. Absolutely. And we are trying to feed back into the SDI system the fact that perhaps some of the technology prioritizing may be based in fact on the ability to test it.

We are trying to create an iterative process where SDI includes that in their prioritizing and judgment of technologies that they would pursue based on the ability to confirm through testing the technology that they are advancing. We don't want to create a technology, obviously, that can't be tested.

They agree 100 percent. So we are trying to make this circular, iterative process work, so they are——

Mr. Dicks. I think that is encouraging.

One of the so-called Nitze criteria for judging SDI is survivability: that the system has to be able to survive, or at least enough of it survive, in order to do the job that is outlined for it, as we get down to decisions further down the road.

Mr. Krings. Right.

Mr. Dicks. It seems to me one of the things you will have to focus on is looking at the survivability of the proposed candidate tracking systems, weapons systems, joint defense systems, all the very things that are being talked about. I think for this particular program that is going to be a high priority since it is a multilayered potentially type system.

Mr. Krings. I might add, General Abrahamson is very, very solicitous of our involvement in this because he recognizes that is really the payoff of what they do.

Mr. Dicks. The staff reminds me that the national testbed simulations are to begin in fiscal year 1988. Are you going to assist in that work?

Mr. Krings. I don't know that answer directly because the particular involvement that we have in looking at all of the test facilities that exist and will be developed is being done in a cooperative way between USDRE and our DOT&E. So we are plugged into what is going on.

Mr. Dicks. You are.

Mr. Krings. Absolutely, yes.

Mr. Dicks. I am talking specifically for the SDI program.

Mr. Krings. In today's technology, in many cases you can design with operational testing. You can actually look at the end product in simulation and effect the design and bridge the gap between basic design in operational capability when you have sophisticated simulations. You can evaluate the candidates of technology in their operational use, and we want to ensure that these testbeds take into consideration simulating the end result as well as the early technology which can be done. Being a part of it early in the ball game, I think we can be reasonably assured that that will be done.

PACKARD COMMISSION RECOMMENDATIONS

Mr. Dicks. Mr. Seraphin.

Mr. Seraphin. Mr. Krings, as long as we are expanding your role in SDI, the Packard Commission has recommended the use of operational testing in just plain old vanilla defense programs, in the advanced development phase.

Does that sound like a good idea to you?

Mr. **Krings**. I guess I am not certain what you mean by advanced development phase.

Mr. **Seraphin**. Well, it is the phase that immediately precedes full-scale engineering development.

Mr. **Krings**. Yes, it is our belief and we are being successful in convincing others that operational testing actually begins with concept development. In the particular programs I have personally been involved in, we designed systems through operational testing.

Now, operational testing doesn't have to be done in the dirt. It can be done in some very sophisticated simulations in which you actually find out which technical candidate wins the battle and go backwards and try to lock that technical candidate into an engineering development.

So I believe that all through the entire development of a weapon system, if you start out with a reasonably verifiable simulation, you can establish the operational capability and criteria basically in simulation. Then you keep developing the real hardware; the ultimate goal is that the real hardware does what the simulation advertised it was going to do, both in terms of techncial achievement and operational capability.

Mr. **Dicks**. Can you give us examples of that?

Mr. **Krings**. Absolutely. I did it for many, many years myself. I was a very active participant in both the F-15 and F-18. Specifically, in the F-18, I spent many an hour, much later than this, in the simulator flying against another person who was flying a very sophisticated high-fidelity MiG airplane simulation in another simulator, and we would literally fight and change the wing design, change the thrust, change the weapons, change the displays. We would try to find out what really works, what really is successful in combat.

If we achieved a certain number of designs that looked good, we would bring in Air Force or Navy personnel, whatever we were doing, that were fighter pilot types, not test pilots, and they would be the real scorers. They would tell you very quickly what won and what didn't win.

We would literally try to lock in those designs and display. You may always think the diamond should be up, the fighter pilot thinks it should be down, and he wins more times with it down, so make it down. The engineers then designed the system around that, which the user has really tested in a user-friendly, test-transparent environment. He goes in there and just tries to kill the other guy.

Through those techniques, both in flying qualities and in weapon system performance and aerodynamic performance, you actually reverse engineer, if you will, and try to in fact build that thing which is successful. It is really design through operational testing.

So I have been in this and I have seen it and then ultimately flown the airplane, and ultimately done the things that were done in simulation. You can do this.

Mr. **Dicks**. Why didn't you have a little more range in the F-18 so Mr. Chappell would be happy with it? A perfect airplane in every respect, I am told, but——

Mr. **Krings**. I think time will show that it probably has enough, even though we could always use a little more, absolutely. There are many schemes to get a little more, the Navy is trying to pursue, and naturally, it is only dollars that keep them from getting that extra range. Anyway, there are techniques to do that. But this is being done in more and more areas——

Mr. DICKS. That would be an interesting example for you to look at. You talk about systems being introduced now.

Mr. KRINGS. I do have the opportunity. We have been very influential in the LHX community, for instance, to try to use this technique, if there is going to be an LHX or when there is an LHX, we should know before we ever even make a selection what it is actually going to do and is that the thing we want it to do. Those things can be very highly valuable with real users.

Mr. DICKS. Anything you can do with LXH would be deeply appreciated.

Mr. Miller.

EMP TESTING FOR THE B-1 BOMBER

Mr. MILLER. Thank you, Mr. Chairman.

Mr. Director, in your statement you say the B-1B is the first strategic aircraft produced with nuclear hardness EMP criteria included in its baseline design.

Mr. KRINGS. Yes.

Mr. MILLER. And the EMP tests required to verify the hardness of this system design and to establish the baseline for this life cycle hardness maintenance and surveillance program was not included in the Air Force 1987 POM submission.

Mr. KRINGS. Yes.

Mr. MILLER. I would think the Air Force would consider that particular point in all of the work they do. Why did you have to come in and say you put in your budget X amount of dollars for this life cycle testing of, I suppose, the skin of the aircraft?

Mr. KRINGS. The whole airplane.

Mr. MILLER. But they left that out or they were not——

Mr. KRINGS. They had to make budgetary decisions in the B-1B program and one of the budgetary decisions was not to do this, yes.

Mr. MILLER. And if it is nuclear hardness testing, would they do it when the plane is being constructed?

Mr. KRINGS. Yes.

Mr. MILLER. Would it be necessary to do it after two years or five years again or once that hardness is in the material, do you feel that vibration or something will soften it up and therefore the test has to be repeated in the future?

Mr. KRINGS. Yes, that is exactly it. Each component was tested for its nuclear hardness. Then the airplane basically was assembled. In this particular airplane we are trying to assure that during the assembly there is proper instrumentation put in it so the total airplane can be subjected to these effects, and we can measure the total airplane nuclear hardness, not just the boxes. Then use that airplane during its operational life to be the leader in determining if this nuclear hardness gets weaker with time. We need some calibration at the front so that we can determine if we are keeping the degree of nuclear hardness necessary through the operational life of the airplane when it is flown and when it is washed and when parts are changed, et cetera, and put back together in its normal life. We want to be sure nuclear hardness doesn't "escape".

But without a basis when it was originally built, literally before it is ever flown, we would never be able to capture later what the degradation, if any, was or how to deal with it.

Mr. MILLER. How are you grading nuclear hardness?

Mr. KRINGS. I wish I could answer that. I am not an expert in nuclear hardness.

In this particular case, the entire weapons system of the B-1 is taken down to the Trestle in Albuquerque and not only have all the parts been tested, but the whole system. There are more talented people than I who know how to measure the effects of nuclear hardness and whether it has achieved——

Mr. MILLER. Perhaps you could have them or you elaborate for the record.

Mr. KRINGS. Yes.

Mr. MILLER. As to how they gauge nuclear hardness.

Mr. KRINGS. Yes, sir. We will.

[The information follows:]

The B-1B EMP test program has been designed to satisfy three broad objectives: (1) Verification of the achievement of the EMP design specification, (2) establishment of a hardness maintenance/hardness surveillance baseline, and (3) evaluation of B-1B hardening techniques for use on future programs. This program relies almost exlcusively on test data and observations collected during simulated EMP exposures and avoids the use of extensive analytical techniques. Its structure includes definition of the data required to support the evaluation, data processing techniques to directly compare test data and design specifications, and establishment of pre-defined decision trees (acceptance criteria) to guide programmatic decisions during the conduct of the test.

The B-1B was designed with a layered approach, using shielding to reduce the EMP stress which drives electronic equipment design to provide sufficient strength to tolerate a specified EMP pulse input. The hardening allocation was translated into a set of specifications for each hardening element. They can be grouped as overall system performance, equipment strength, and system stress specifications, respectively. Each specification is accompanied by a procedure to demonstrate compliance. These specifications include a top-level requirement that the aircraft complete the mission when exposed to the EMP environment and specifications for each of the Line Replaceable Unit (LRU) shielding elements, including LRU surface current specifications, commonmode core current (CMCC) specifications, and individual wire specifications. The test approach uses measurements based on system specifications which are verifiable and related to the basic stress and strength at common interfaces in the interior of the aircraft. This approach allows for direct comparison of stress and strength levels at all mission-critical connectors. It eliminates the use of analytical modes for detailed coupling analysis equipment failure and also uses a common system test reference point (the CMCC) that is directly related to the B-1B contractor specifications.

Following contractor verification of cable shielding integrity and compliance with LRU EMP specifications (direct drive sine wave input), the system-level testing will commence. That program has been organized into two phases, consisting of six specific test elements. Phase 1, anticipated in the summer of 1987, is an initial survey of the aircraft or aircraft subsystems. This phase includes the first two test elements: (1) Preliminary direct drive tests, and (2) preliminary low-level survey tests. Resulting data will be used in planning the high-level pulse test and providing insight on accessibility of test points and anticipated levels of induced transients.

Phase 2, consists of the remaining four test elements (using aircraft #100), and is anticipated to commence in the summer of 1988 and last approximately six months. It will be performed at Kirtland AFB, NM, using the Trestle, horizontally polarized dipole (HPD), vertically polarized diple (VPD-II) and direct drive facilities. It will consist of high-level pulse, direct drive and low level hardness surveillance testing.

First, testing will be conducted in a power-on, operationally realistic aircraft configuration with an experienced flight crew on board. This element of the test will provide observations of upsets or other anomalous behavior as the result of a simulated EMP environment. The second element will be high-level pulse testing in a power-off mode, which will comprise the bulk of the test effort. In this element, data will be collected on 100 percent of the cables to mission-critical LRUs. This data will be processed to account for operational variations, test uncertainty and simulator deficiencies to establish upper bound stresses at each input to each mission critical LRU. Measured stress data, collected in the simulator environment, will be directly compared with strength data obtained by direct driving each LRU, and will result in high confidence conclusions while reducing the testing error margins. The third element of the test will be the evaluation and location of upsets or anomalies observed during power-on testing and a follow-on correlation to high power testing.

Finally, testing will be conducted using the hardness surveillance test system to establish a hardness surveillance/hardness maintenance baseline for the B-1B aircraft. Data will be taken in an "as delivered" condition of the aircraft as well as with hardening elements intentionally degraded. These degradation tests, replicated from high-level pulse degradation measurements, will be used to establish the ability to detect and locate hardening degradations over the aircraft's life span and quantitatively determine their effects.

Mr. MILLER. The only other question that I have is do we have information regarding the contracts that you let, and if not, I think it would be good, Mr. Chairman, if we had a copy of that for the record. I am sure you have this organized, of what contracts you let for what purpose to whom and for how much.

Mr. KRINGS. Yes, sir, we can definitely provide that for you.

[CLERK'S NOTE.—The information requested by Mr. Miller is printed in response to committee questions on Program Responsiblities, staffing, and budget requests" and appears on page 344.]

Mr. MILLER. Thank you, Mr. Chairman.

AMRAAM CERTIFICATION

Mr. DICKS. Mr. Krings, in December 1985, you advised Secretary Weinberger that certification of the Advanced Medium Range Air-to-Air Missile (AMRAAM) before March 1986 would be a problem since "there is a low probability of adequate test results being available for an operational capability forecast before March."

However, on February 28, 1986, Secretary Weinberger did certify to the Congress that AMRAAM would be able to meet its operational specifications. This certification was required prior to March by the fiscal year 1986 Defense Authorization Act or the program would, by law, have to be terminated.

How many test firings were to have been completed by March 1st, and how many were actually conducted?

Mr. KRINGS. I would like to correct a few things in the statement and then I would be more than glad to answer.

I did not advise the Secretary there was a problem with it. I advised him basically of the limited operational test data that would be available at the time of certification so that he would be able to judge the quality of the testing information that he got and the quantity of it.

Secondly, he was certifying primarily to performance specifications as opposed to operational test specifications—that is, operational capability. But those are two "small" issues.

I was using my judgment to alert him to the limited operational test data that would be available, based on the fact that few of the tests that had been originally scheduled would in fact be completed.

By 1 March we were to achieve somewhere in the area of 13 launches, some of which were operational, some of which were development. It is a combined test and includes both development and operational testing.

In fact, there were, I think, five. I don't remember the exact numbers. But a significant——

Mr. **Dicks**. You can correct that in the record.

[The information follows:]

Five test launches were carried out prior to 1 March 1986. Two of these were unguided launches of the Separation Control Test Vehicle, or SCTV. Three were guided SCTV launches.

Mr. **Krings**. I simply wanted to make him aware of the amount of testing that had really been done even though he wasn't certifying to operational capability, because that is a function to be done later for production as opposed to certification.

Mr. **Dicks**. What problems caused the delays in this test program, including the failed missile launch on Jaunary 29, 1986?

Mr. **Krings**. Hardware, the quality of hardware. You could even narrow it down even more so. The most significant probelms that have been witnessed to date are those problems prior to launch, single-wire-type systems that are in many cases safety devices to preclude a missile from being launched if it has a fault in it. Those systems were in fact less sophisticated than the weapon system that was going to function after launch. In many cases they actually precluded the launch because they sensed a false indication of failure, and there were not redundant systems in that area.

One-wire systems that precluded launch; that is where the focus has been recently.

Mr. **Dicks**. Do you agree with the GAO that "current plans show that many additional launch tests are to be made by 1988. By then, these tests may have determined the ability of the missile to perform in accordance with the development specifications"?

Mr. **Krings**. Yes. In fact, if one would look at the profile of expenditure of production funds, in all cases these steps in production funding are preceded by operational tests that are significant in number. The percentage of dollars that goes into production, that is, expended in production, is always lower than the percentage of operational tests that have been done, so the operational test curve, if you will, accumulating operational data to make those judgments, does in fact precede the awarding of those production contracts.

According to the schedule, that is something obviously that we want to ensure: That the spending doesn't get ahead of the testing.

Mr. **Dicks**. Are there other programs that you have warned the Secretary about, and when you do that, do you also notify the Congress? How does that work?

Mr. **Krings**. These cases have basically been, if there is a Secretary program review and the Services are going to explain the status of the program or he has to make some sort of a judgment, then I try to inform him of anything I know that I think will help him make a judgment in terms of the question, "Will it work"?

Obviously, if there is a decision to go into production, even low-rate production or high-rate production, we submit a written report to both the Secretary and the DSARC principals.

In the case where there is a review and it is an interim status review, then I don't necessarily make my views public.

Mr. DICKS. All right.

Well, thank you. I appreciate your patience waiting this late in the evening. I thought you gave a very good report and we certainly hope we can work very closely with you.

Our staff obviously does a lot of this day-to-day work and we hope you will give them your full cooperation. We will submit the remainder of the questions for the record.

Mr. KRINGS. We certainly will and thank you, Mr. Chairman.

[CLERK'S NOTE.—Questions submitted for the record and the answers thereto follow:]

PROGRAM RESPONSIBILITIES, STAFFING, AND BUDGET RESOURCES

QUESTION. Mr. Krings, since your office is relatively new, perhaps you could briefly describe the responsibilities of the office, why it was established, and what magnitude of staff and budgetary resources you have to conduct the program.

Mr. KRINGS. These matters are fully addressed in my formal statement, which has been included as a part of the record.

QUESTION. Title 10, section 136 of the U.S. Code states that your office shall "monitor and review all operational test and evaluation in DoD", as well as analyze the results of all operational testing conducted on major acquisition programs, of which there are over 100. This seems like an extraordinary task for the 23 staff in your office.

How do you select programs to monitor? It there a dollar value or acquisition cateogry (ACAT) level which serves as a dividing line for inclusion in your program?

How many of these 23 staff are professional evaluators and how many are administrative?

Mr. KRINGS. Program-selection criteria are specified in law, sections 136a and 139 of Title 10. All programs meeting Selected Acquisition Report criteria automatically fall under the purview of our office for operational test oversight purposes. In addition, section 136a gives me the power to designate programs of special interest for our oversight. Special interest may be determined by demonstrated Congressional concerns, media interest, interoperability concerns, and so on.

Our current staff of 23 is comprised of 17 professionals and 6 administrative personnel.

QUESTION. How many staff-years of work are contracted out by your office for FY 1986? What is planned for FY 1987?

Mr. KRINGS. We do not contract out assessment or judgmental activities. These are strictly in-house staff functions. Instead, we obtain technical and analytical expertise by contract. We have three technical support contractors: BDM, Electronic Warfare Associates (EWA), and the Institute for Defense Analyses (IDA). The man-year estimates for technical support provided are as follows:

	Fiscal year—	
	1986	1987
BDM	17.4	18.4
EWA	5.4	17.0
IDA	31.2	31.3
Total man-years	54.0	67.2

Note.—17.7 of the above technical man-years are in direct support of joint operational test and evaluation.

QUESTION. Your FY 1987 budget represents a 6 percent increase over FY 1986. However, the overall increase for RDT&E is 24 percent. How do you anticipate keeping up with this continued rapid expansion in development programs with virtually no real growth in your own funding?

Mr. KRINGS. First, our direct costs for oversight of operational test programs—travel and analytical support—are relatively small. Second, since the other major cost driver—joint tests—is controllable, we can accommodate reasonable changes in demand for OT&E support resources. That is, we can limit the number of joint test starts and the level of effort. In the future, as we become involved in OT&E earlier and participate in prototype evaluations, we may see significant increases in our funding requirements.

QUESTION. Your budget request for FY 1987 includes $2.5 million for special projects. What are these?

Mr. KRINGS. Our special projects costs for FY 1987 are now almost $3 million. These projects include development of an electronic warfare threat simulation capability data base and related analytical support by Electronic Warfare Associates for approximately $1.9 million; automation of the JEWC threat simulator data base and development of some unique test capabilities for approximately $500 thousand; and the review by independent management consultants of current test and evaluation facility/capability management, funding and investment policies for $500 thousand.

QUESTION. Mr. Krings, your statement mentions that you have established a good working relationship with the GAO. Why did you believe it necessary to make such a statement?

Mr. KRINGS. In addition to being the Secretary's principal advisor on operational test matters, I also serve a similar function for the Congress, and thus in some respects my responsibilities are similar to those of the GAO. I wanted the Congress to know that my office and the GAO have established a good and productive working relationship designed to preclude duplication, allow for cooperation on mutual-interest programs whenever possible, and to promote better understanding of potential differences in our evaluations.

TEST AND EVALUATION MASTER PLANS (TEMPS)

QUESTION. Recently, the Defense Inspector General has issued a series of reports which indicate that the DSARC process is not working effectively. The lack of required documentation at DSARC reviews often includes the Test and Evaluation Master Plan (TEMP), which is the primary description of proposed testing and the resources needed to carry out that testing plan.

What percentage of TEMPs for Acquisition Category I programs does your office plan to review in FY 1986?

Mr. KRINGS. Acquisition Category I programs are programs that meet Selected Acquisition Report criteria. We have included in the new DoD test and evaluation directive (DoDD 5000.3) a requirement for annual review of all TEMPs. And, as I have noted here, the Secretary, the Deputy Secretary, and I agree that a DSARC will not be held for any program that does not have an up-to-date and approved TEMP. What all this means is that all existing Acquisition Category I program TEMPS and TEMPs which must be prepared for such programs during FY 1986 will be reviewed by DOT&E during this fiscal year.

QUESTION. During FY 1985, your office reviewed a number of TEMPs, resulting in 17 approval actions and 16 comment, change, or disapproval actions. This appears to indicate that the probability of a test plan being approved by your office with no changes is approximately 50 percent. Is this accurate? If so, are there ways to better select programs which might need stronger guidance in development of their test plan?

Mr. KRINGS. As with many such statistics, appearances are deceiving. The numbers reflected were intended to provide some notion of an activity level and not an approval or disapproval rate. Since our focus is on the merits of the individual OT&E program, we do not maintain approval/disapproval statistics. Further, the process of review is not a one-time event. Frequently, there are numerous visits, telephone calls and informal comment activities that occur before a formal review occurs and actual correspondence is exchanged. This further complicates maintenance of any statistics. Nonetheless, intuitively we know that "first blush" approvals are extremely rare.

Regarding the question of program selection, the criteria (Selected Acquisition Report criteria) are specified for us by law. In addition to the SAR grouping of over 100 programs, we designate programs of special interest for review. Special interest may be determined by Congressional attention, media interest, interoperability concerns, or any one of a multitude of other possible reasons. We find that this total population of programs (approximately 150) covers all that will have a significant impact on our defense posture and that there are more than a few that need substantial guidance. That is, we do not need to seek them out.

OPERATIONAL TEST RESOURCE INVESTMENT STRATEGY

QUESTION. A survey of existing operational test assets and needed improvements in that capability is being undertaken by your office.

(1) When will this work be completed?

(2) Is this going to provide a prioritization of improvement areas as well as an analysis of cost and schedule requirements?

(3) Does it appear at this point that significant funding increases will be necessary to improve our OT&E plant, equipment, and overall capability?

Mr. KRINGS. First, let me clarify that, as most test assets support both DT&E and OT&E, we are surveying assets that can support OT&E vice OT&E assets per se. Our current effort is adressing the asset question on two fronts—EW threat simulation capability and space test capability. We have targeted the DoD FY 88/89 budget summer review cycle as the point at which we should have sufficient results to identify budget issues, including cost and schedule information. Although it is too early to project bottom line costs, we do know that space test capability shortfalls will require major investments ($3–6 billion) over the next 5–10 years.

FY 1987 BUDGET INITIATIVES

QUESTION. Mr. Krings, your statement describes six T&E related issues which your office successfully argued in the FY 1987 internal DoD budget deliberations. Except for the issue of funding for your office, all of these items involve programs which the Air Force apparently planned to underfund. Is it coincidental that all of these issues involved the Air Force?

Mr. KRINGS. We reviewed all of the Services' test and evaluation related POM submissions for FY 1987. The issues mentioned in my formal statement were those which remained unresolved after our discussions with the Services and which we believed to be of sufficient importance to carry to the Defense Resources Board.

AMRAAM CERTIFICATION

QUESTION. What is the statistical reliability of conclusions based on the number of flight tests conducted to date? Isn't a larger number of flight tests normally required to provide high statistical confidence in the reliability of the estimate?

Mr. KRINGS. First, let me note that the AMRAAM certification was not required to be made solely on the basis of completed flight tests, nor should it have been, nor was it. Certification clearly required that the Secretary of Defense apply his judgment, taking into consideration a wide array of factors. While it is true that system-level flight test data was limited at the time of certification, the success of those early tests as well as those subsequently completed provided increased confidence (not statistically quantifiable) that the underlying design is complete and is consistent with the Decision Coordinating Paper requirements. Obviously, if we depended exclusively on flight testing for establishing confidence, a large sample would be required, but of course, flight testing is only one of many factors.

[CLERK'S NOTE.—End of questions submitted for the record.]

WEDNESDAY, APRIL 9, 1986.

AIR FORCE RESEARCH, DEVELOPMENT, TEST AND EVALUATION

WITNESSES

HON. THOMAS E. COOPER, ASSISTANT SECRETARY OF THE AIR FORCE, RESEARCH, DEVELOPMENT AND LOGISTICS

LIEUTENANT GENERAL BERNARD P. RANDOLPH, UNITED STATES AIR FORCE, DEPUTY CHIEF OF STAFF, RESEARCH, DEVELOPMENT AND ACQUISITION

INTRODUCTION

Mr. CHAPPELL. The committee will come to order.

Pursuant to a motion passed in open session, this hearing will be held in Executive Session because of the classification of the material to be discussed.

This afternoon, the committee will receive testimony on the fiscal year 1987 request of the Air Force for Research, Development, Test and Evaluation funds. That request totals $17.3 billion, and covers some 238 separate budget line items. We hope to cover a number of representative topics today, as a supplement to the RDT&E issues which have been raised in several of our other hearings on Air Force programs.

Our principle witnesses are Hon. Thomas E. Cooper, Assistant Secretary of the Air Force; and Lieutenant General Bernard Randolph, Deputy Chief of Staff for Research, Development and Acquisition.

Gentlemen, we welcome you and your colleagues. Your entire prepared statements will be made part of the record. You may proceed. In the interest of time, we ask you to summarize.

[CLERK'S NOTE.—The joint statement of Dr. Cooper and Lt. Gen. Randolph on Aircraft Procurement, Missile Procurement, and Research, Development, Test, and Evaluation has been printed in connection with the hearing on Aircraft Procurement, Air Force programs. See Part 6, page 146.]

Dr. COOPER. Thank you, Mr. Chairman.

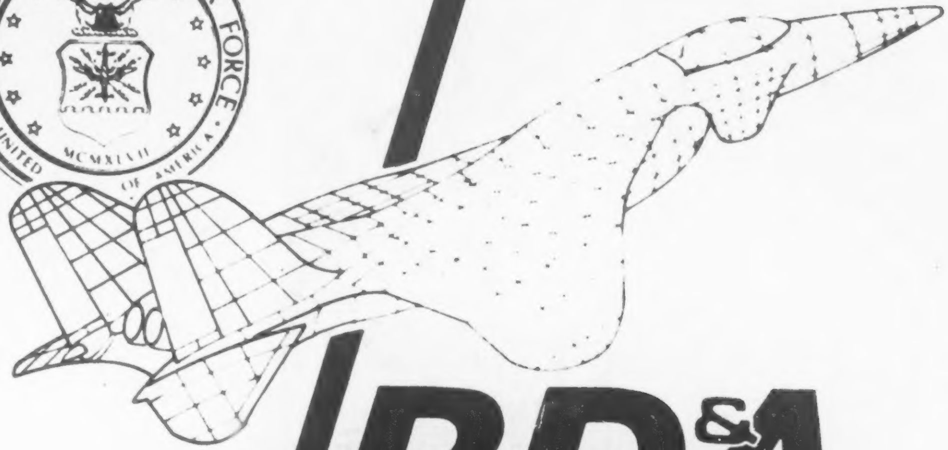
I believe in the interest of time I will forego any opening remarks that I might have. You have our complete statement previously in the record. I think in the interest of time I will turn directly to General Randolph and let him give you a quick overview of our RDT&E budget request, if that meets with your approval.

SUMMARY STATEMENT OF GENERAL RANDOLPH

Mr. CHAPPELL. General?

General RANDOLPH. Mr. Chairman, I appreciate the opportunity to appear before the committee, and what I would like to do is briefly go through the RDT&E request for the Air Force and just give you a few highlights, and then we will answer questions.

[Slides follow:]



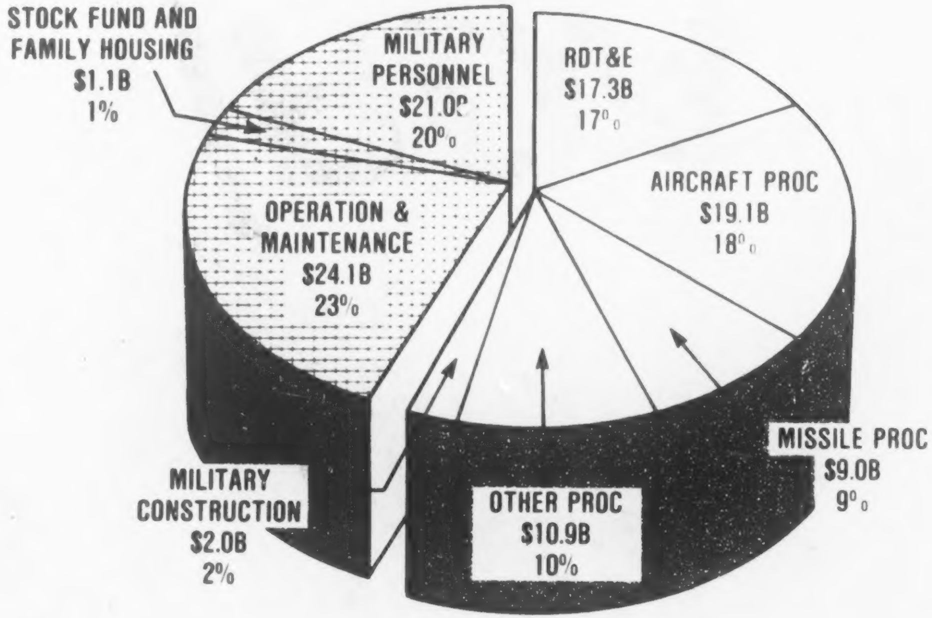
RD&A

Lt General BERNARD P. RANDOLPH

DCS/Research, Development & Acquisition
Headquarters United States Air Force

USAF FISCAL YEAR 1987 BUDGET REQUEST BY APPROPRIATION

TOTAL: $104.5B



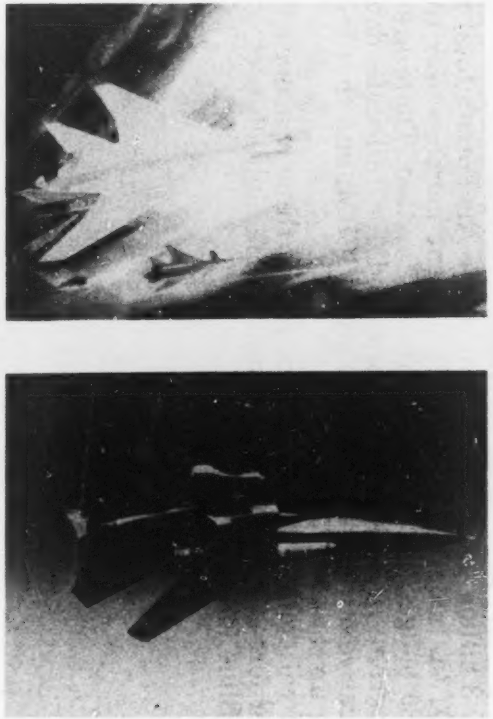
General **Randolph**. As you pointed out, the RDT&E budget is $17.3 billion, about 17 percent of the Air Force's total request. That RDT&E budget is about a 21 percent increase over the fiscal year 1986 budget, but there is a reason for that. There are a number of programs that are being proposed for full-scale development in fiscal year 1987, such as the small ICBM, and that is what is driving up that RDT&E budget.

I will go into the programs. I have three charts covering the theater forces. I will touch on some of the highlights.

[Slide follows:]

THEATER FORCES

	FY 1987 ($ IN MILLIONS)
TACTICAL FIGHTER PROGRAM	
• ADVANCED TACTICAL FIGHTER	294
• F-15 SQUADRONS	209
• ALTERNATE FIGHTER ENGINE	109
• F-16 SQUADRONS	81
• ENGINE MODEL DERIVATIVE PROGRAM	68
• INEWS/ICNIA	60
• NIGHT PRECISION ATTACK (LANTIRN)	40
MUNITIONS ACQUISITION	
• SURFACE DEFENSE SUPPRESSION	44
• ADV MED RANGE AIR-TO-AIR MISSILE	39
• ARMAMENT ORDNANCE DEVELOPMENT	30
• HARDENED TARGET MUNITION	15
• WIDE AREA ANTI ARMOR MUNITION	15
• HYPERVELOCITY MISSILE	10



THEATER FORCES

General **Randolph**. We are asking to move more aggressively into the Advanced Tactical Fighter.

If you will recall, the advanced tactical fighter is a replacement in our air superiority fighter area. It will be 20 years from the time we first flew the F-15 to the time we first fly the advanced tactical fighter, if the program moves along on its present schedule.

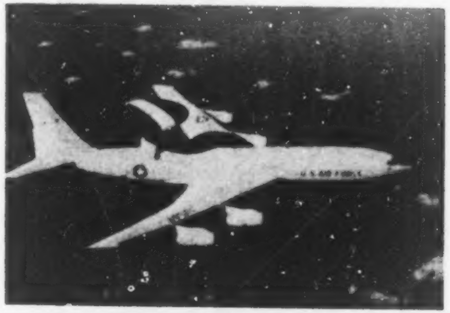
I might also point to the LANTIRN program on the chart. The targeting pod today is in the IOT&E phase and coming along well, and we hope to make a production decision for the targeting pod this spring.

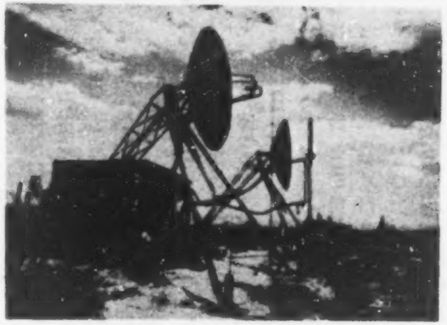
The navigation pod is already in production at this time. In the munitions area, we have discussed with the committee the advanced medium-range air-to-air missile. We have had two more successful tests since we last appeared before this committee.

[Slide follows:]

THEATER FORCES (CONT)

	FY 1987 ($ IN MILLIONS)
BATTLEFIELD MANAGEMENT	
• JOINT SURVEILLANCE AND TARGET ATTACK RADAR SYS	356
• AIRBORNE WARNING AND CONTROL SYSTEM	137
• INFRARED SEARCH AND TRACK SYSTEM	35
• ADVANCED COMMUNICATION SYSTEMS	33
• TACTICAL AIR RECONNAISSANCE SYSTEM	31
• PRECISION LOCATION STRIKE SYSTEM	27
• JOINT TACTICAL FUSION PROGRAM	25
• TACTICAL AIR CONTROL SYSTEM	19
• TRAFFIC CONTROL/APPROACH/LANDING	19
• JOINT TACTICAL COMM PROGRAM	11
• COMBAT IDENTIFICATION SYSTEM	12
• UNMANNED AIR RECON VEHICLE	4





BATTLEFIELD MANAGEMENT

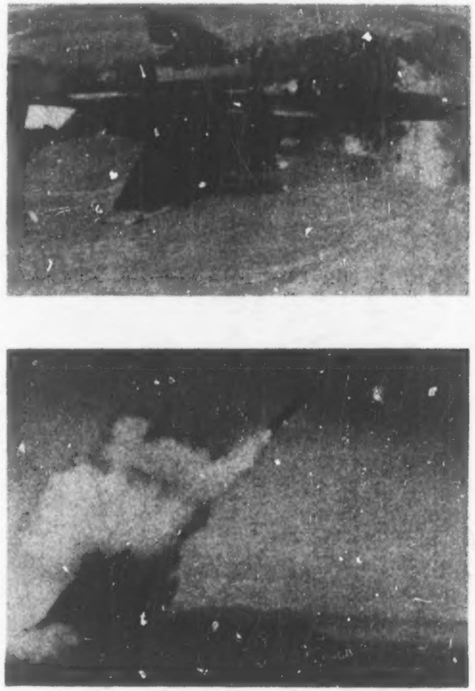
General RANDOLPH. The second theater forces chart talks about battlefield management-type programs. The important thing to point out here is that most of these programs are joint, either in terms of program construction or joint in the sense of the use made of the particular programs.

The Joint Surveillance Target Attack Radar System, Joint STARS, is on contract moving forward quite smoothly, and we believe that we will indeed meet the 1989 demonstration date that we have previously proposed to the Congress, assuming that we get approval for the moneys shown on this chart.

[Slide follows:]

THEATER FORCES (CONT)

	FY 1987 ($ IN MILLIONS)
DEFENSE SUPPRESSION AND ELECTRONIC COMBAT	
• TACTICAL PROTECTIVE SYSTEMS	95
• FROTECTIVE SYSTEMS	93
• F-4G WILD WEASEL SQUADRONS	39
• EW COUNTER RESPONSE	34
• TAC C^3 COUNTERMEASURES	25
• AIRBORNE SELF-PROTECTION JAMMER	10
THEATER NUCLEAR FORCES	
• GROUND LAUNCHED CRUISE MISSILE	7



ELECTRONIC COMBAT

General **Randolph**. The final chart in the theater forces area has to do with electronic combat. We in the Air Force have been very concerned with the success, or some of the lack thereof, that we have had in the electronic combat area. We have made some major adjustments in our organization to try to come to grips with that problem.

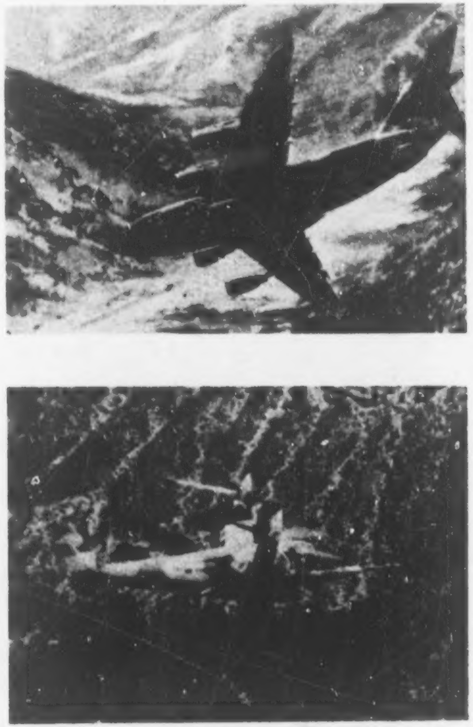
Within my organization, I have consolidated all the electronic combat talent into one unit. In the field organizations, the Air Force systems command and Air Force logistics command have pulled their development and acquisitions together so we can get the area under better control.

In the area of ground-launched cruise missiles, there is money to do additional testing.

[Slide follows:]

FORCE PROJECTION

	FY 1987 ($ IN MILLIONS)
AIRLIFT	
• C-17	612
• AIR FORCE ONE	9
SPECIAL OPS	
• SPECIAL OPERATION FORCES	67
• CV-22 (JVX)	5



FORCE PROJECTION

General **Randolph**. In the force projection area, the C-17 is a program—that is very critical to us in terms of being able to support the Army. I am prepared to discuss that more later. We believe that is a program that should move forward as aggressively as we can.

AIR FORCE ONE

We have a problem in the Air Force One area, but we are hopeful the Congress will help us by approving the program. We are currently in source selection and are prepared to make a source selection and are prepared to make a source selection given that we get the green light from the Congress to proceed. The importance is to maintain the competition because the Douglas line on the KC-10 is about to close. If we don't do the competition now, we really will not have a competitor that is able to meet Air Force One requirements.

Dr. **Cooper**. If I might point out that is one of the issues that is currently caught up in the appropriation without authorization category.

Last year we came forward with an out-of-cycle request. You granted us $280 million in the appropriation process for procurement of two aircraft along with about $20 million for R&D. That money we currently have, but it lacks an authorization.

The Senate supplemental authorization bill has provided us with that authorization. The House bill has zeroed it so we are awaiting the outcome of that conference before we can move forward.

Mr. **Miller**. Before you move off that point, you are talking about two that you were supposed to have. Up here we project nine. How many do we have now?

General **Randolph**. This is $9 million here in RDT&E money and that is to do testing.

Mr. **Miller**. Let's get back to Air Force One. How many do we have?

Dr. **Cooper**. Two.

Mr. **Miller**. Would you retire those two when the other two come in?

General **Randolph**. No, sir. The two airplanes that the President now uses would be put into the special air missions fleet to support other senior members of the government other than the President.

So we will retain those airplanes, but they will not be used to support the President.

Mr. **Miller**. How many do we have in the support system right now?

General **Randolph**. I would have to provide that information for the record.

Mr. **Miller**. It is not 40 or 50?

General **Randolph**. No; it is nine aircraft.

Dr. **Cooper**. We will correct this for the record. I believe we have nine of that category, aircraft. Of course, two are designated Air Force One. The two currently in the fleet would move back into the normal fleet to be replaced by either a DC-10 or a 747, depending on which one wins the competition. Two older VC-135s would leave the special air missions fleet for other military duties.

[The information follows:]

The Special Air Mission (SAM) fleet presently contains 19 aircraft, two of which are the Air Force One aircraft. The remaining 17 aircraft are used to support the Vice President and other senior executive and Congressional leaders. As the Air Force acquires new aircraft (such as the DC-10 or the B-747), the new aircraft displace, one-for-one, the existing SAM aircraft which we reassign to other military missions within the Air Force or retire, as appropriate. The net result is a constant-size SAM fleet.

Mr. MILLER. Thank you.

SPECIAL OPERATIONS FORCES

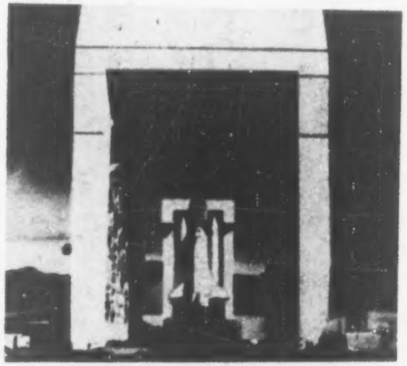
General RANDOLPH. Special operations forces, we previously covered.

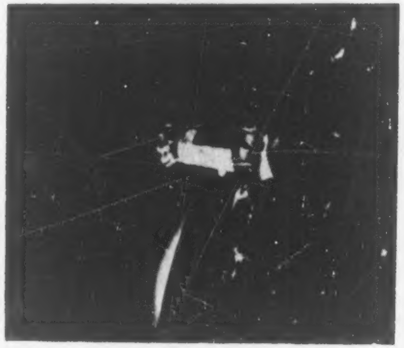
As you recall, the Department has completely revamped the special operations forces approach to make sure that we respond to the direction by the Congress to get the special operations equipment up to the levels that are required.

[Slide follows:]

SPACE OPERATIONS

	FY 1987 ($ IN MILLIONS)
SPACE LAUNCH AND OPERATIONS	
● SPACE SHUTTLE OPERATIONS	176
● SPACE BOOSTERS	139
● CONSOLIDATED SPACE OPS CENTER	94
● SATELLITE CONTROL FACILITY	92
● SPACE TEST PROGRAM	74
SATELLITE SYSTEMS	
● DEFENSE METEOROLOGICAL SAT PROGRAM	64
● NAVSTAR GPS (USER EQUIPMENT)	45
● NAVSTAR GPS (SPACE/GND SEGMENTS)	44





SPACE OPERATIONS

General RANDOLPH. In space operations, I know that Secretary Aldridge was just here to brief the committee on some of the things in his area, and I am not sure whether he covered the recovery program, but if he did not, we are prepared to discuss the proposed recovery program that the Department has as a result of the Challenger tragedy.

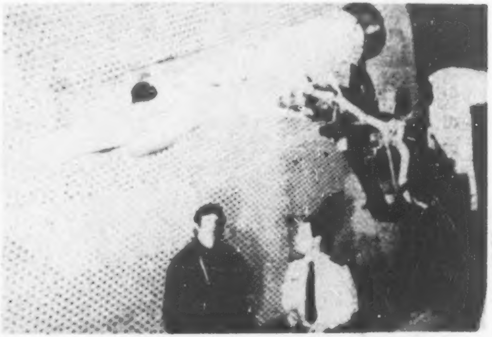
The Consolidated Space Operations Center facility work has been completed, and we are currently conducting operations at a lower level from the Consolidated Space Operations Center, so we are beginning to use that.

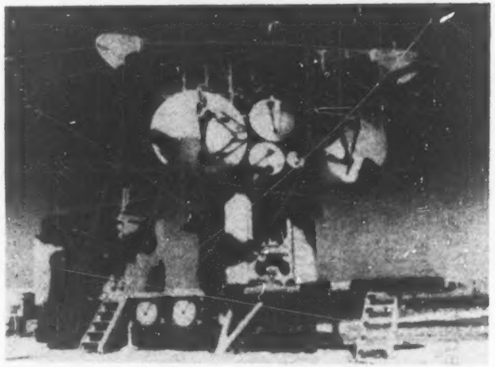
In the case of satellite systems, both the NAVSTAR GPS satellite and the weather satellite are multiyear procurements that have been previously approved by this committee and are going along exactly as previously approved.

[Slide follows:]

TEST AND EVALUATION

	FY 1987 ($ IN MILLIONS
• TEST AND EVAL SUPPORT	304
• IMPROVED CAPABILITY FOR DT&E	90
• RANGE IMPROVEMENT	65
• RDT&E AIRCRAFT SUPPORT	62
• NAV/RADAR/SLED TRACK TEST SUPPORT	26
• ELECTROMAGNETIC RADIATION TEST FACILITY	6



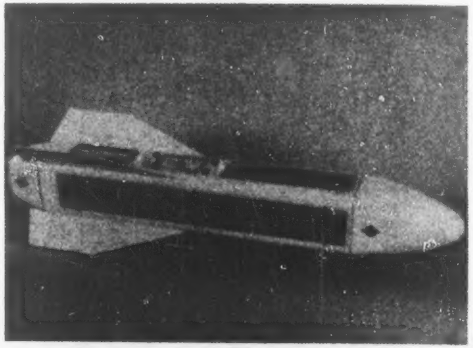


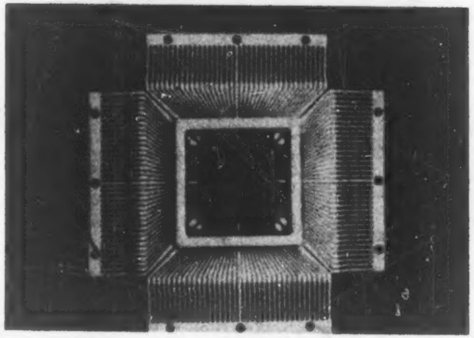
TEST AND EVALUATION

General **Randolph**. In the test and evaluation area, what you see here are the moneys necessary to keep our ranges up to date to make sure that we are able to respond to the testing needs both in development testing and in the initial operational test and evaluation areas.

[Slide follows:]

SCIENCE AND TECHNOLOGY





	FY 1987 ($ IN MILLIONS)
TECHNOLOGY BASE	
• DEFENSE RESEARCH SCIENCES	213
• CONVENTIONAL MUNITIONS	50
ADVANCED TECHNOLOGY DEVELOPMENT	
• VERY HIGH SPEED INTEGRATED CIRCUITS	133
• NATIONAL AEROSPACE PLANE TECH	33
• AEROSPACE STRUCTURES/MATERIALS	32

SCIENCE AND TECHNOLOGY

General **Randolph**. The science and technology portion of our RDT&E budget is basically the tech base, the kinds of things necessary to stay up with the threat.

I would like to call your attention to two very high visibility and interesting items. The Very High-Speed Intergrated Circuit work is proceeding along quite well. We have finished Phase I and are in the process of inserting that technology into some of our existing systems.

For example, we have a jamming pod called the ALQ–131, wherein we have replaced one of three transmitter control assemblies with a Very High-Speed Integrated Circuit technology assembly. The result of that replacement is that we have improved its reliability by an order of magnitude or ten times.

Of course, the National Aerospace Plane is the so-called single-state-to-orbit airplane that can take off from a normal runway and put payloads into orbit at considerably less money than with the shuttle.

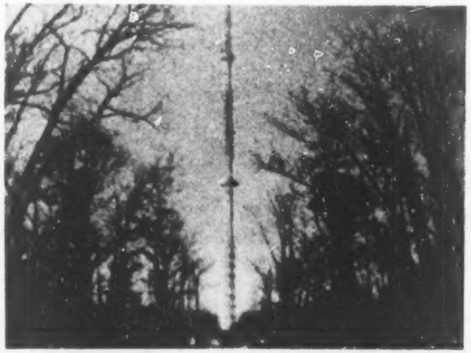
STRATEGIC C^3 PROGRAM

The MILSTAR is the centerpiece of the strategic C^3 program and has a very high priority in the Administration and is proceeding along as currently planned.

[Slides follow:]

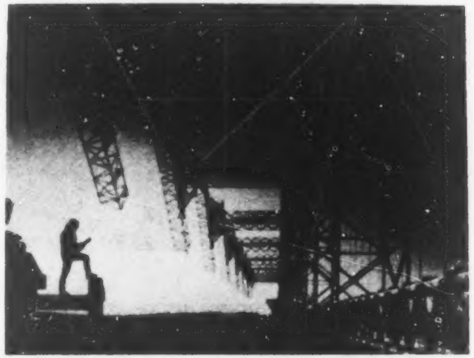
STRATEGIC C^3

	FY 1987 ($ IN MILLIONS)
• MILSTAR	493
• MILSTAR SAT COMM SYS (AF TERMINALS)	299
• WWMCCS INFORMATION SYSTEM	119
• MINIMUM ESSENTIAL EMER COMM NET	93
• SPACE COMMUNICATIONS	36
• COMMAND CENTER PROCESS/DISPLAY SYS	27
• DEFENSE SAT COMM SYSTEM	14



STRATEGIC DEFENSE

	FY 1987 ($ IN MILLIONS)
ATMOSPHERIC SURVEILLANCE AND DEFENSE	
• OVER-THE-HORIZON RADAR	34
• ATMOSPHERIC SURVEILLANCE TECH	32
• CRUISE MISSILE SURVEILLANCE TECH	17
• DEW RADAR STATIONS	14
SPACE SURVEILLANCE AND DEFENSE	
• ASAT	278
• DEFENSE SUPPORT PROGRAM	138
• NORAD CHEYENNE MOUNTAIN COMPLEX SPACE DEFENSE SYSTEMS	41
• SPACETRACK	16



STRATEGIC DEFENSE

General **Randolph**. In the Strategic Defense area, the Over-The-Horizon Radar, if you recall, has finished the construction of the three segments on the East Coast. We are in the process of doing the testing. Once that testing is completed and fully integrated, we will have an initial operational capability in the ——— time period.

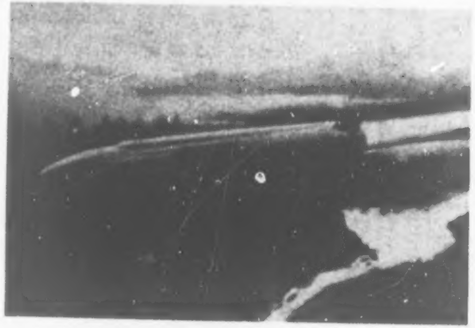
And finally also in the strategic defense area, these are some upgrades to the SLBM Radar Warning System the so-called PAVE-PAWS radars, particularly the one in the Southeast in Georgia. The purpose of that upgrade is to make sure that we have support for being able to detect and track objects in space.

[Slides follow:]

STRATEGIC DEFENSE (CONT)

	FY 1987 ($ IN MILLIONS)
BALLISTIC MISSILE WARNING AND ATTACK ASSESSMENT	
● SLBM RADAR WARNING SYSTEMS (FAVE PAWS)	20
● BALLISTIC MISSILE EARLY WARNING SYS	16

STRATEGIC OFFENSE



		FY 1987 ($ IN MILLIONS)
ICBM LEG		
• ICBM MODERNIZATION		2117
SMALL ICBM	1376	
ADVANCED BASING TECH	389	
PEACEKEEPER	352	
• ADVANCED STRAT MISSILE SYS		177
• MINUTEMAN SQUADRONS		68
BOMBER LEG		
• SHORT RANGE ATTACK MISSILE II		165
• B-1B		119
• PROTECTIVE SYSTEMS		93
• COMMON STRAT ROTARY LAUNCHER		15
• STRAT/CONV STANDOFF CAPABILITY		7
• AIR LAUNCHED CRUISE MISSILE		6

STRATEGIC OFFENSE

General **Randolph**. Of course, you are all familiar with the ICBM modernization program. This is one of the things that I pointed out as one of the major reasons for the 21 percent increase in the RDT&E budget. It is almost $1.4 billion for the development of the small missile in order to make the 1992 IOC that has been directed by the Congress. That program as you recall went from no program at all in 1983 to beginning full-scale engineering develoment toward the end of this calendar year if the program proceeds as is currently planned.

Mr. **Livingston**. What is your IOC?

General **Randolph**. Ninety-two, sir.

Mr. **Livingston**. Thank you.

[Slide follows:]

MAJOR RDT&E PROGRAMS

($ IN MILLIONS)

SMALL ICBM	$1376
C-17 PROGRAM	612
MILSTAR SATELLITE COMMUNICATIONS PROGRAM	493
ICBM ADVANCED BASING TECHNOLOGY	389
JOINT SURVEILLANCE TARGET ATTACK RADAR SYSTEM	356
PEACEKEEPER	352
TEST & EVALUATION SUPPORT	304
MILSTAR SATELLITE COMMUNICATION SYSTEM (AF TERMINALS)	299
ADVANCED TACTICAL FIGHTER (ATF)	294
ASAT	278
DEFENSE RESEARCH SCIENCES	213
F-15 SQUADRONS	209
ADVANCED STRATEGIC MISSILE SYSTEMS	177
SPACE SHUTTLE OPERATIONS	176
SHORT RANGE ATTACK MISSILE II (SRAM II)	165
SPACE BOOSTERS	139

MAJOR RDT&E PROGRAMS

General **Randolph**. Finally, this is my last chart, and it is a recap of some of the major programs in terms of dollars. This is not a priority order chart; it is simply in descending order of the dollars being requested. That is about a third of the dollars that we have in the Air Force RDT&E program, and of course we are prepared to discuss any of the items that are on that chart. Sir, that concludes my brief overview of the Air Force fiscal year 1987 RDT&E request.

Dr. **Cooper**. Mr. Chairman, one point I would like to make. We could have a pretty good hearing on the last chart. That is most of our major efforts.

ASAT PROGRAM

On the anti-satellite program, I would like to inform the committee that we have restructured the program now. As you know, out of last year's appropriations conference there was restrictive language that said that we could not test against an object in space during fiscal year 1986.

Our original plan had been to conduct two tests against an object in space, two instrumented test vehicles were going to be the test objects, and to make one test against the radiant energy of a star. Because of the restricted language, we now plan two tests, both against the radiant energy of a star. We believe that is in compliance with the law and that is the plan of the department.

Right now the first test will be in —— and the second in ——.

Mr. **Miller**. That is coming in the back door.

Dr. **Cooper**. No, sir. I don't believe so. As you may recall, the year before we had restrictive language that said we could not test against an object in space. With that language in place and with the concurrence of the Congress we did test against the star.

Mr. **Miller**. I am for testing. I just wonder what we use for argument if that comes up. We are testing in space, but not against a solid object.

Dr. **Cooper**. The language is not treaty language; it is language that is in the law. It is our own law, and so we are not testing against a mass or an object itself. We are just testing against a point in space.

C-17 PROGRAM

Mr. **Chappell**. Mr. Secretary, I notice that the second largest item there in the billing was the C-17, $612 million for RDT&E this fiscal year.

How much have we spent in RDT&E on the C-17?

Dr. **Cooper**. Total?

Let me extract that for you. I can get that in just a moment.

Mr. **Chappell**. About $400 million, I think.

Dr. **Cooper**. That sounds about right—you mean to date?

Mr. **Chappell**. You can give it to us.

Dr. **Cooper**. I will get you an answer.

General **Randolph**. Prior to fiscal year 1986, we spent $238 million. In fiscal year 1986, you approved $372 million and we are in the process of using that money, so $400 million to date is about right?

Mr. **Chappell**. You are almost doubling in this one year. How much more is it going to cost us?

Dr. **Cooper**. The total bill is slightly under $4 billion.

Mr. **Chappell**. For RDT&E?

[Slide follows:]

C-17

($ IN MILLIONS)

	FY 85 & PRIOR	FY 86	FY 87	FY 88	TO COMPLETE	TOTAL
RDT&E	238.7	372.8	614.2	925.0	1902.7	4053.4
WPN SYS PROC	—	—	217.3	1382.8	28,438.0	30,038.1
QUANTITY BUY	—	—	—	2	208	210
DELIVERIES	—	—	—	—	210	210

FY 87
RDT&E REQUEST
$ 614.2

• AIR VEHICLE	253.4
• TEST & EVAL	117.4
• PEC SUPPORT	97.1
• SIM DEV	1.9
• OTHER	144.4

FY 87
WPN SYS
PROC REQUEST
$ 217.3

• NONRECURRING	182.3
• ADV BUY	35.0

SCHEDULE

• MILESTONE II DECISION (FSD)	FY 85
• PRODUCTION START	FY 88
• IOC	FY 92

General **Randolph**. It is on the chart that you see here.

Dr. **Cooper**. We are talking roughly $36 billion for 210 aircraft. This also is our first year for procurement. You recall in the earlier hearing we had $217 million requested.

Mr. **Chappell**. How much of this is for procurement?

Dr. **Cooper**. This is all procurement.

General **Randolph**. Of the $217 for procurement, most of that is non-recurring costs to set up the line with a small amount to do the beginning of the advanced buy.

T-46 PROGRAM

Mr. **Chappell**. If you went forward with the T-46, what would be the moneys necessary for this year, 1987?

General **Randolph**. It depends on the scenario that you could paint, but if you took a scenario that said that you would go forward with about 30 airplanes, you would need something on the order of about $250 million, $300 million to set up the line.

Mr. **Chappell**. Just run through some figures—if you took about $150 million out of RDT&E and $50 million out of procurement and went forward with your T-46 aircraft, would that be a good move?

General **Randolph**. Let me answer it this way, Mr. Chairman. We could execute a program of that nature if the Congress so directed.

Mr. **Chappell**. How much have we spent on the T-46?

General **Randolph**. We have spent $437 million to date, $285 million of RDT&E, about $15 million for simulators, and $137 million for the first ten airplanes.

Mr. **Chappell**. So that is about what you have spent so far on the C-17, right?

General **Randolph**. Yes, sir. That is correct.

F-109 ENGINE PROGRAM

Mr. **Chappell**. I notice that you are asking for substantial moneys for the development of the F-109 engine. Wasn't that specifically for the T-46?

General **Randolph**. Yes, sir, that was put together specifically for the T-46, and we would propose, since we have moved forward so far with that engine, that we should go ahead and complete development of that engine.

Mr. **Chappell**. If it was developed for the T-46, why are you asking additional money for it, since you are not going forward with the T-46?

General **Randolph**. The engine could be used on other airplanes.

Mr. **Chappell**. Which airplanes?

General **Randolph**. We don't have an airplane right now.

Mr. **Chappell**. If you don't have another airplane you need it for, does it make sense to spend another $10.7 million on perfecting this engine for the T-46? You are going to throw out $400 million in sunk costs for T-46 development. I can't help but find myself at odds with you fellows on that program. I am wondering if it is right for the economy of the country. Maybe something could be done with the C-5 and some other, and we could spend a little less money on the C-17. That might keep us from just throwing the money away that was spent on the T-46 program that the Air Force said it just had to have.

Now, I begin to get a little concerned about the engine. I begin to get concerned about how well we are spending some of these other moneys.

General **Randolph**. It is our proposal, and I recognize this doesn't respond directly to what you are saying, but it is our proposal to complete the development work both on the airplane and the engine, and buy the drawings and the necessary data so that we could complete that at some time at a later point when we have more funds available. So that is the proposal.

Dr. **Cooper**. Mr. Chairman, may I comment on that to go back to when we made the decision on the T-46.

First and formost, we view it as a priority issue and as an affordability issue. There was a decision made by Secretary Orr and General Gabriel in October that we were going to try to preserve healthy programs, and if need be, make vertical cuts to sacrifice programs that were not healthy.

At that point in time the T-46 was a sick program.

Mr. **Chappell**. That is not true today, is it?

Dr. **Cooper**. Mr. Chairman, I would not say today it is a healthy program.

Mr. **Chappell**. Would you say it is an unhealthy program?

Dr. **Cooper**. I would say it is in better shape than it was in the October timeframe, but I am not convinced that it is out of the woods yet. Having said that, if a decision were made to go forward with the T-46, I think it is a program that could be done. It would take longer and cost more money.

T-37 PROGRAM

Mr. **Chappell**. How much are you going to spend on the T-37?

Dr. **Cooper**. We think the bill for the T-37 will not be large, certainly not large relative to the T-46.

Mr. **Chappell**. How much are we talking about?

Dr. **Cooper**. I don't have the figures. It is a fairly nominal sum to keep the T-37 fleet operational for the next five years.

Mr. **Chappell**. Do you have the figures on it?

T-37 ADDITIONAL LIFE

General **Randolph**. What we have in our budgets right now is enough money to go through an inspection at the 15,000-hour point, and to be able to extend the life to 18,000 hours; 18,000 hours by our estimate will give us about six years more life on the T-37.

Mr. **Chappell**. Why didn't you have the foresight to do that back when you were selling the T-46?

General **Randolph**. It is clear to me, that we put together the rationale to purchase the T-46 because we needed to have a more efficient way to do our training. That doesn't mean we cannot——

Mr. **Chappell**. Is that still true?

General **Randolph**. Yes, sir, but that does not mean that we cannot do our training. We can do the training. It is just that it is not as efficient as we would like it to be. In the final analysis we are going to have to do something either to the T-37 fleet some years hence either in terms of upgrade or replacement. However, there is time available that we quite frankly did not expect would be available. We felt that the airplane would be in difficulty at 15,000 hours.

We now have two airplanes that have reached the 15,000-hour point. We have inspected those airplanes and cleared them to go 18,000 hours. It turns out we have had to do nothing to the airplane in order to achieve the additional life.

T-37 SAFETY FACTOR

Mr. **Chappell**. The previous testimony was that you had serious safety problems with the T-37.

General **Randolph**. The testimony before, I believe, said that under certain conditions, temperature conditions, the single engine performance of the airplane on takeoff was potentially a problem, yes, sir. That is true, but those are only under a certain set of conditions, and——

Mr. **Chappell**. But apparently you anticipated you might have those conditions occur.

General **Randolph**. Yes, sir, and——

Mr. **Chappell**. That is the safety factor.

General **Randolph**. Yes, but it is also an efficiency factor, because if we reached a point where we have a safety problem because of the temperature of the day and the situation, we just won't fly.

OPERATING COSTS

Mr. **Chappell**. How much more did it cost you to operate the T-37 than you anticipate would be the case with the T-46?

General **Randolph**. The operating costs of the T-37 are only slightly more than the T-46 in the day-to-day operation costs.

Mr. **Chappell**. General, that isn't what you testified to before, is it?

General **Randolph**. I do think so.

Mr. **Chappell**. My recollection is—and you remember I was one of those who was very reluctant about the T-46.

Dr. **Cooper**. T-34C, I remember that was one of the issues.

Mr. **Chappell**. And one of the problems was—it took you too long to climb to altitude, to get to the training area, too long to get back, the whole thing was inefficient and costing money and you just had to have it. Now we are throwing out those sunk costs and in essence starting over again at a future time.

I have real difficulty seeing the logic of that.

Dr. **Cooper**. It is the budget, Mr. Chairman. I don't think the requirement for a trainer has gone away. If the question were, if it were bought and paid for, would we prefer to have a T-46 over a T-37, no question, but I think in the budget climate that we face both in 1986, 1987, 1988 and beyond, we are going to be forced to live with some less than optimum solutions.

C-17 FUNDS REDUCTION

Mr. CHAPPELL. Let's talk a little bit on the C-17. If you pull out $100 million RDT&E, what will that do to the program?

Dr. COOPER. C-17, RDT&E would not be the place to pull the money out. I think that would wound the program. I wouldn't recommend that we take it out of the C-17. We have already made that priority decision. You would probably have to slip the production.

Mr. CHAPPELL. How much?

Dr. COOPER. It depends on how much money you were going to pull out of it, but it would slip the production and cause the price of the C-17 to ultimately go up and stretch it and make it less efficient.

MIDGETMAN PROGRAM

Mr. CHAPPELL. Mr. McDade?

Mr. McDade. Thank you, Mr. Chairman.

I would like to spend a little time talking about the Midgetman. It looks as though there is some dispute occurring about whether or not it ought to be a single warhead system or multiple. It is extremely critical for us to know about this because of the ramifications that this question has.

What I would like you to do is summarize the key arguments for us, what are the benefits and the costs associated with the single warhead plan and its MIRV'd alternative.

If you can state an Air Force position, I would like to know that.

Dr. COOPER. Let me take a swing at that. I don't know that I would categorize it as a dispute right now. We are coming up on a decision to enter full-scale development of the small missile in about the December time frame. That is a very key milestone.

As you probably know, the program that we are currently pursuing is the single warhead in the 30,000-pound class. It is progressing very nicely.

There have been a number of questions asked about whether or not it might be more prudent to build a small missile that would carry more than one warhead, and that may be a good idea if it would maintain the same mobility as the single warhead small ICBM. That is the issue that Dr. Hicks is pursuing, and he chairs the upcoming DSARC that will make that decision.

He has asked us to go in and look at options for the small missile that would carry two warheads and indeed even three warheads to see if those variants would maintain the same mobility as a single warhead small ICBM.

We are in the process of doing that. We have an intensive effort ongoing at the Ballistic Missile Office to look at a variety of options so that information will be available when we make that decision.

In the meantime, we are continuing to march down the path of developing the single warhead small ICBM so the decision point that we face will be in the December timeframe. At that point we will reach a fork in the road, and we will either decide to continue into the next phase of the development of the single warhead small ICBM or perhaps the decision would be to come back and propose to you that we grow that missile to either two or three warheads if we can tell you that the mobility will stay the same and the survivability will stay the same.

The advantage, if it doesn't maintain its mobility of going to two or three warheads, is that we think it will be less costly because the cost per fielding each warhead we think will be considerably less if you have multiple warheads. So the Air Force position is stay the course now, continue with the development of the single warhead small ICBM and stay tuned and see what happens in December when we convene the DSARC.

SOVIET MISSILES

Mr. **Livingston**. Is the SS-25 multiple warhead?

Dr. **Cooper**. No.

Mr. **Livingston**. Is it ———?

Dr. **Cooper**. Yes.

General **Randolph**. Yes.

Dr. **Cooper**. The 25 is in the ——— class.

General **Randolph**. Yes, approximately—it is roughly the size of Minuteman. The 25 is the missile that they already have deployed and it is, as I understand it, the single warhead missile. The 24 is a peacekeeper-class multiple warhead missile nearing IOC and capable of both silo and rail-mobile basing.

Dr. **Cooper**. The SS-X-24 is up well in excess of ———. It is a big missile. That is essentially where we are, Mr. McDade. I think there has been a lot of misunderstanding about what the position is of the Administration.

The Administration's position is the same as it has always been, deploy 100 MX's, and we are looking for a more survivable basing mode for the next 50 and vigorously pursuing alternate basing technologies.

There is another exercise to make sure when it comes time to go into the second phase of the small ICBM that we are building the right small ICBM. I remember the Scowcroft Commission and the battle that we had and the need to preserve a consensus on where we go, which is all part of that problem, too, I think.

I think the issue for the nation would be that if you could build a three-warhead or two-warhead small ICBM that maintained all the mobility of the single warhead, that proposition would be more cost effective and wouldn't that be a more prudent way to go.

General **Randolph**. In fact, it would really meet the concept that was developed by the Scowcroft Commission, because basically what they said was: "What is the price that the Soviets would have to pay in order to attack?" If you can maintain the same mobility and the same degree of survivability, the price to attack is the same, and yet on our side we get more for it.

Mr. **Livingston**. That is the key question, you had an if in there and you had to put the if in, but if you begin to sacrifice survivability or mobility——

Dr. **Cooper**. It is not a good idea.

General **Randolph**. That is the issue that we are looking at now.

OPTIMUM SINGLE WARHEAD SMALL ICBM

Dr. COOPER. I think the assumption was originally made that if you get much above 30,000 pounds, you lose your mobility. We are looking into that. If it is not the case and there is nothing magic about 30,000 pounds, you could go to a higher weight allowing you to carry more warheads, and thus, you would have a more cost-effective system.

There is another issue that is on the table. We don't have a formal proposal to you, but we would like to discuss it. If you stay with the single warhead small ICBM, is 30,000 pounds the right weight? Our view now is 30,000 pounds is slightly constraining and that the optimum single warhead small ICBM, would be more in the range of about 37,000 pounds, giving us 250 pounds more payload which would allow us to put penetration aids on it. It gives you a more flexible missile.

If you don't care to add penetration aids, it gives you more range, so we believe the optimum size is more on the order of 37,000 pounds. We are constrained by law now to no more than 33,000 pounds. I think it would be prudent to raise that to the 37,000-pound level.

PRICE AMENDMENT

That law came from the Price amendment. The Scowcroft Commission said that we should build a missile at about 15 tons, 15 tons is 30,000 pounds. I think there was a concern in the Congress that we would grow to the point that it wouldn't be mobile, so we were locked in at 30,000 pounds.

That was two years ago, and I think we should revisit that and take another look if we stay with the single warhead small ICBM.

MULTIPLE WARHEAD SYSTEMS

Mr. DICKS [presiding]. The major issue is whether with the mobile system you can go up to say two or three warheads. With mobility the Soviets have to barrage it so it isn't like a fixed land-based missile system in terms of stability. That was the argument, that you wanted single warhead systems because they were stabilizing.

I am told you have to go up to around 67,000 pounds if you want a two- or three-warhead missile and you have to increase by about 20 percent the size and diameter of the vehicle.

Dr. COOPER. A couple of things happen. If you get much above 40,000 pounds on a missile, you have to increase its diameter. That means your vehicle is going to be wider and your weight is going to go up as you grow. Those two could restrict mobility, and at some point they will. We are examining now where is the knee in the curve where you really start to drop off in mobility.

Perhaps you could go as high as 45,000 to 50,000 pounds with two warheads and maintain the mobility. Right now we think it is doubtful you could go to three warheads.

Mr. DICKS. Some say you could have two warheads and use the third spot for penetration aids.

General RANDOLPH. Mr. Dicks, one of the issues that we are also examining is the possibility to do some redesign on the warheads to get two warheads on a smaller missile.

Mr. DICKS. You mean a smaller warhead?

General RANDOLPH. The shape of the warhead, not smaller in terms of yield, but different in terms of shape so they could fit on the diameter. I don't know whether that is possible, but that is being looked at in this examination. There is no doubt in our minds that weight has some impact on mobility. The only question is, "Can that be overcome?" It is certainly a whole lot easier technically if we can keep that weight down so if there is a way to reshape the missile and put two on and keep the mobility, that is the best of all worlds, but nobody knows whether that is possible today.

ASAT TEST PROGRAM

Mr. DICKS. I wanted to ask a question about the antisatellite program. The DoD has indicated that it will comply with congressional direction prohibiting the testing of the anti-satellite weapon against an object in space as long as the Soviets show similar restraint. In light of that and the cost and schedule problems, the program has been approved for restructuring.

Under the restructuring of the program, what is the test program planned for fiscal year 1986?

Dr. COOPER. Our plan is to have two tests. Our original plan before the restricted language prohibited testing against an object in space was to have two tests against objects in space and a third test against the radiant energy of a star.

Subsequent to that proposal, the restrictive language out of the appropriations bill, said we could not test against the object in space. Our current plan is to restructure the program, and we plan to test against the radiant energy of a star in ——— and have a second test in ——— against the radiant energy from a star.

ASAT SENSOR REACTION

Mr. DICKS. What would you learn from these tests?

General RANDOLPH. Of course, the tests would exercise all of the systems that you have on the ASAT with the exception of the end game. More importantly, Mr. Dicks, one of the things that we are very much concerned about is when you have the IR sensor looking down low toward what is called the earth limb, IR energy coming off the earth, can you look at a low-flying satellite, detect that low-flying satellite and be able to intercept it. That is very critical information for us to understand, how the sensor reacts to radiant energy from the earth.

So we propose to not only home on a star, but make the ASAT look very low toward the earth as it is pointing toward a star so we can see the effects of the IR signature of the earth.

ASAT RDT&E FUNDS

Mr. DICKS. In fiscal year 1986, the Congress deleted procurment funds for this program and transferred them to the R&D effort. How do you plan to utilize these funds?

General **Randolph**. If you recall the program started out as a prototype program and then we were going to go from the prototype into production because we felt we could make that jump. The Under Secretary of the Air Force directed that an independent review of that approach be done last year. That independent review concluded that it was not a prudent course of action, that it was too large a jump to go from prototype to production so we have incorporated a producibility enhancement program which addresses the actual production in a more efficient manner, but secondly, it addresses the business of bluesuit maintenance. Is the machine configured so that it is easy for the bluesuiters to maintain?

That is what we intend to do with the additional RDT&E money provided by the Congress.

SDI PROGRAM APPLICATION

Mr. **Dicks**. The Chairman of the House Armed Services Committee has come out against the ASAT program. Up to this point we have been talking about testing against an object in space. He says that consideration should be given to using some of the potential SDI technologies that are being developed to the anti-Satellite mission and not go forward with this particular program.

If the Congress provided no funds in fiscal year 1987 for this program, would Air Force press for greater attention to potential ASAT applications for programs being explored by SDI?

General **Randolph**. Mr. Dicks, the SDI programs, and I think the reference there is to lasers, the SDI laser work is moving along about as quickly as the technology permits.

As you know, that is a high priority program with the Administration. Therefore, I don't see that adding money would do anything to the program in terms of being able to move it forward at any faster pace. That is the first point.

The second point is that we are some number of years away from the point where we can make a decision as to whether or not those approaches would be useful in the anti-satellite role.

We are certainly open to that, and we are following that technology very closely.

As you know, the Air Force is an agent for SDI in some of that work so we are watching that very closely to make sure that we can take advantage of that technology at the right time. In fact, as a result of the thoughts along that line, we truncated our buy to ——— missiles as opposed to the ——— that we originally planned with the idea in mind that in the early nineties we would relook at that and decide whether or not the technology of the lasers had come far enough so that we could then use that technology to complete our ASAT capability as needed.

But in the meantime, because it is some years downstream, we really don't have anything that we would propose to continue on with the buy as we have in our fiscal year 1987 proposed budget.

Dr. **Cooper**. I think the bottom line on that is that what you would be asking us to do in that case is to give up a bird in the hand for one that is in the bush and we prefer to maintain the near-term capability.

Mr. **Dicks**. Mr. Young?

JSTARS PROGRAM

Mr. Young. Thank you, Mr. Chairman.

Mr. Secretary and General, for a long time I have supported the JSTARS program and the ATACMS as an important weapons part of that system. I get a little concerned about survivability in light of the new Soviet SAM missile, the SA-X-12. I have an understanding that the SA-X-12 would have a range of up to ———.

I would like to ask you to describe the ability of JSTARS to stand off beyond the ——— whether it has that capability or where we stand in view of this new threat?

General Randolph. If I may, I have a couple of charts on JSTARS I would like to show you.

We, too, are concerned about the survivability of JSTARS. We believe that the approach that we have for the program is prudent. Let me just use this chart as a start.

[Slide follows:]

INTRODUCTION

C-18 Joint STARS SURVIVABILITY ACHIEVED THROUGH A COMBINATION OF:

- STANDOFF RANGE
- WARNING
- TACTICS
- COUNTERAIR DEFENSES
- SELF-PROTECTION

EMPLOYED TOGETHER IN A CONCEPT OF OPERATIONS DESIGNED TO ASSURE SURVIVABILITY IN A COMBAT ENVIRONMENT

General **Randolph**. The way we achieve that survivability is through the five techniques that you see right here. The one that you were particularly talking about is the standoff range. If your understanding of the SA-X-12 is correct, it is ——— and that does cause us some concern.

This is how we approach the problem. You asked the range. This is typically the way we would propose that the C-18 fly.

[Clerk's note.—Classified slide removed.]

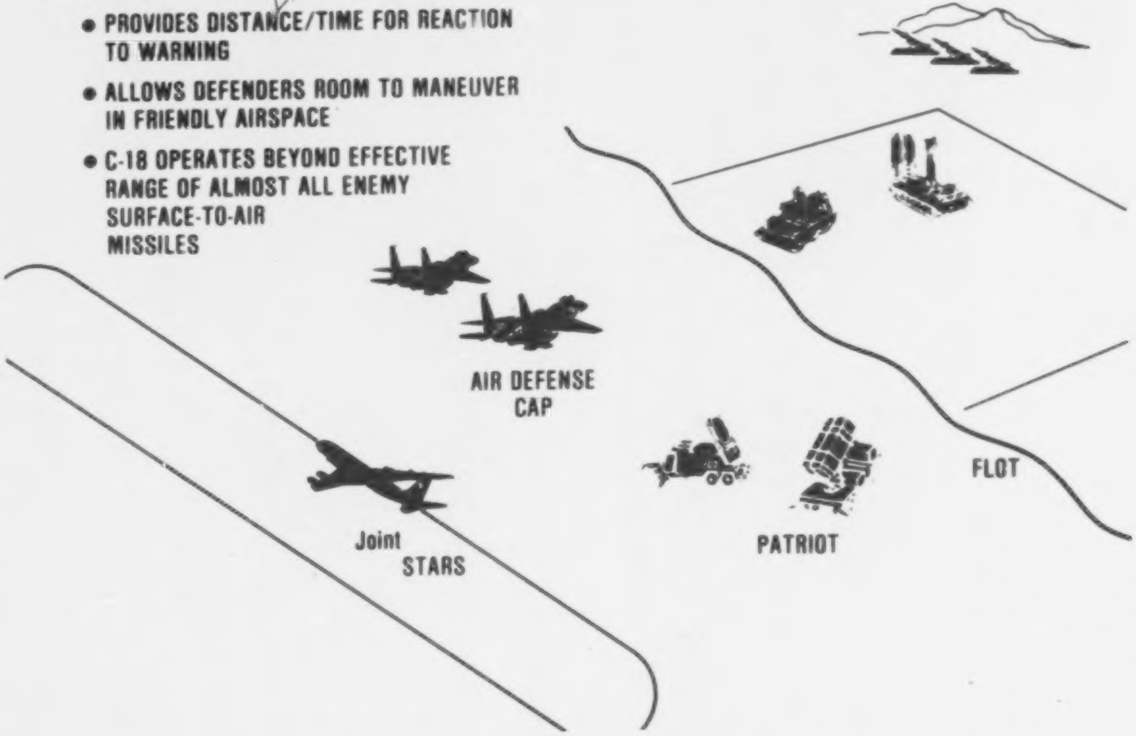
General **Randolph**. About ——— from the forward line of troops being able to look into the battle area by about ——— and this is a notional area that the airplane would cover as he goes back and forth into the orbit.

As you can see, anything from this point on in terms of the location of as SA-X-12 would be in position to actually cause problems for the C-18. What we do with that is on the next chart.

[Slide follows:]

STANDOFF RANGE

- STANDOFF ALLOWS DEFENSE IN DEPTH
  - PROVIDES DISTANCE/TIME FOR REACTION TO WARNING
  - ALLOWS DEFENDERS ROOM TO MANEUVER IN FRIENDLY AIRSPACE
  - C-18 OPERATES BEYOND EFFECTIVE RANGE OF ALMOST ALL ENEMY SURFACE-TO-AIR MISSILES


AIR DEFENSE CAP
Joint STARS
PATRIOT
FLOT

JSTARS SURVIVABILITY

General **Randolph**. First of all, we have an air defense cap that we propose to use, plus the munitions that the Army would use, and we must identify missiles of the type of the SA-X-12, and we have to go after those missiles in order to assure that the Joint STARS remain protected.

What you have to also understand, Mr. Young, is that if he is very close to the forward line of troops, that he has put himself in danger and it is very easy for us to work against him. Once he steps back, when you add up that ——— in the area we need to look at, we believe he is going to be on the edge unless he wants to put himself in a position where he is vulnerable to our F-15's.

Mr. **Young**. What is the range of the radar?

General **Randolph**. ——— is the extent of the radar range.

SOVIET SA-X-12 EFFECTIVENESS

Mr. **Young**. Does the very high speed on the SA-X-12—the information I have is that it has anywhere from ———?

General **Randolph**. It is a supersonic missile. I am not sure of the exact numbers that you mention, but it is definitely supersonic, definitely high speed, and we must provide protection by interdicting the missile itself, which is something that we would do anyway. If you recall, the AWACs would be flying back here, the Rivet Joint, which is the ECM aircraft, would be flying there, the EF-111's would be flying in that area so it is necessary for us to provide protection to those airplanes. So it is not simply the Joint STARS airplane, but all of those airplanes that would need a high degree of protection.

If, in fact, we believe that the situation become too hot for the time being, the JSTARS would have to fall back until such time as we could clear out that area.

Mr. **Young**. Is the SA-X-12 designed to be effective against a particular type of target?

General **Randolph**. No, sir, it is not. It is just airborne targets as a class, not any particular type. It is not designed, for example, to work against an AWACS or against a Joint STARS.

Mr. **Young**. It doesn't fall into the category of an SA-5, for example, which is designed for a high flying target? This could be a high or low flying target?

General **Randolph**. That is correct. The real issue that evidently they are trying to do is to reach out and get targets at as long a range as we can. As long as the radar is effective, and the limiting factor is how low can the radar look, as long as the radar is effective, then it can work against the airplane.

Mr. **Young**. So you feel fairly comfortable that the JSTARS will be a viable system?

General **Randolph**. Absolutely. Clearly when somebody is shooting at you, you are never comfortable, but we believe that we have the answers to protecting the JSTARS.

ENGINE MODEL DERIVATIVE PROGRAM

Mr. YOUNG. Let me ask you about the engine model derivative program and the fighter engine program. The 1987 program reflects a reduction of some $30.8 million and $67.34 million respectively to projected spending profile that you gave the committee last year.

In both cases, this year's summary cites the decision to go with a more moderate increase in thrust as a reason. Are you comfortable that this more moderate thrust is going to provide you with an adequate engine?

Dr. COOPER. We are. What we budgeted for, and I think we mentioned this last year, was for a higher thrust level that could go above 30,000 pounds.

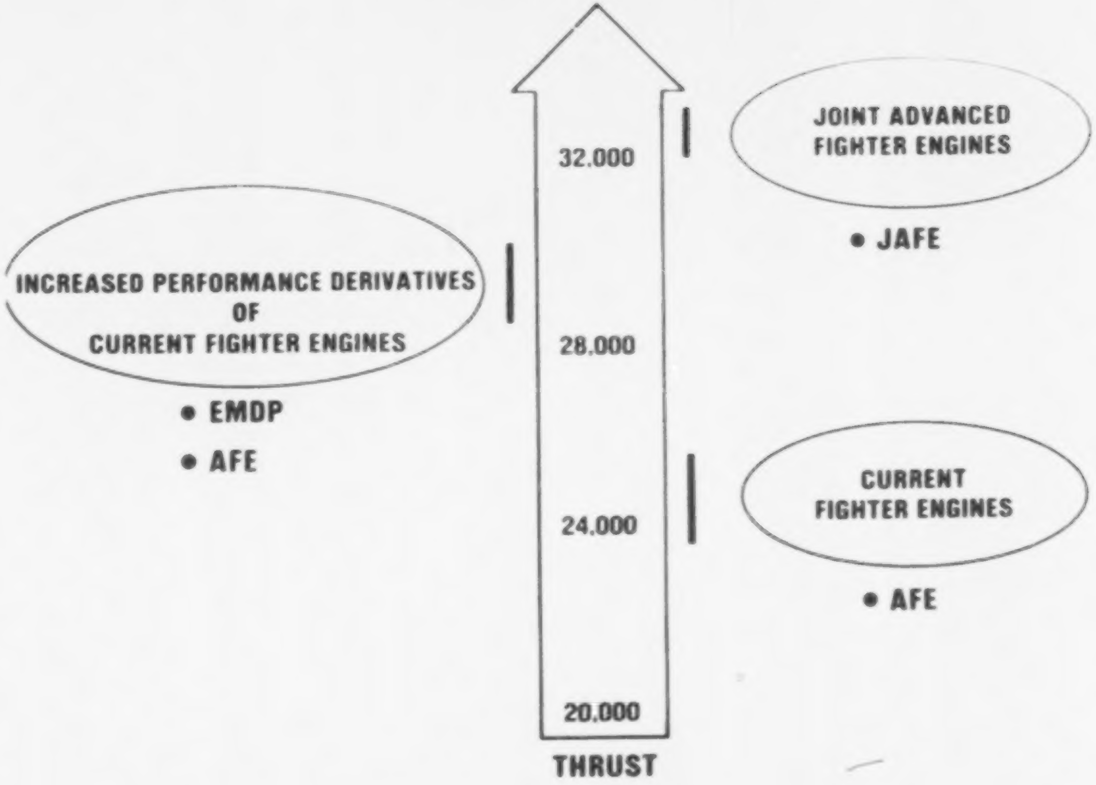
Now we are looking at engines in the class of about 29,500 pounds. That is what has allowed us to take money out of the budget, and, yes, we are comfortable with the 29.5. We believe that gives us the adequate performance.

ENGINE PERFORMANCE

Mr. YOUNG. Compare the 29.5 to existing engines.

[Slide follows:]

ENGINE PERFORMANCE



JOINT ADVANCED FIGHTER ENGINES

- JAFE

INCREASED PERFORMANCE DERIVATIVES OF CURRENT FIGHTER ENGINES

- EMDP
- AFE

CURRENT FIGHTER ENGINES

- AFE

32,000
28,000
24,000
20,000
THRUST

Dr. COOPER. The 29.5 right now with the F-100 is about 24,000 pounds, and if you go to the F-110, the G.E. engine, you are up in the 26 or 27.5 range.

Mr. YOUNG. Still more thrust than what we are using today. What had you intended to go to before you dropped back to the 29,000?

Dr. COOPER. We had not made a decision as to what the final number was. We had never intended to go higher than that or lower than that. Based on what we thought our performance requirements were, the 29.5 range met those requirements.

Mr. YOUNG. Do you feel comfortable in view of new Soviet aircraft development—you mentioned the Soviets were making some large gains in fighter aircraft development. The MIG-29, for example.

Dr. COOPER. Yes.

Mr. YOUNG. Are you still satisfied and comfortable?

Dr. COOPER. We are satisfied and what we are backing that up with is the Advanced Tactical Fighter. So it is a combination of improving the fleet that we have out there today with the upgraded engine for our F-15s and 16s, to be followed by an Advanced Tactical Fighter. We think that fleet will cope with the threat.

General RANDOLPH. The upgrades we are proposing for the 16 and 15 would respond to the MIG-29 and the SU-27. However, ——— and that is one of the reasons why we are concerned about moving forward, as Dr. Cooper said, with the Advanced Tactical Fighter.

Dr. COOPER. I just might point out again, I think you know this, Mr. Young, but raw thrust is not the only parameter we use in looking at performance. It is thrust to weight, also. While the F-100 engine is down about 24,000, it weighs less than the G.E. engine, which is up around 27,000 pounds. As a matter of fact, the thrust to weight of the F-100 engine is greater than the thrust to weight of the F-110. In certain parts of the operational envelope that is an advantage. In other parts it is a disadvantage. So when you look at those two engines, you are somewhat comparing apples to oranges.

At 29.5, both of those engines we think will give us the required performance we will need.

AIRCRAFT ENGINE COMPETITION

Mr. YOUNG. You are right. I remember very well the discussions about the engines on the question of thrust and whether thrust was at issue and whether intakes would be allowed to be increased in size, et cetera.

In view of your reduced funding request and reduced thrust of the engine, will this have any effect on the competition involved in the aircraft engine business?

Dr. COOPER. No. In fact, we think that at 29.5 we will have a very vigorous competition between Pratt & Whitney and General Electric. We look at that as round two of the great engine war. Round three will be in what we call the Joint Advanced Fighter Engine, which will power the ATF. That is again, Pratt & Whitney and

General Electric. We can look for great competition in the upgrade and in the new engine.

Mr. YOUNG. As you know, the Navy made a decision to have both companies produce the same engine.

Dr. COOPER. Yes.

Mr. YOUNG. Are you giving any consideration to that kind of approach?

Dr. COOPER. No, we didn't. In fact, we took the opposite approach, that we felt it was important to keep Pratt & Whitney and General Electric going head to head with their own engines, different engines, whereas the Navy, with the F-404 being a more mature engine, decided to give the Pratt & Whitney people the authority to build the print. It is a different approach. There are pros and cons to each one. We are satisfied with the approach we are taking.

General RANDOLPH. One of the important things to keep in mind, Mr. Young, is that we are making sure that either engine, for example in the case of the so-called JAFE engine, either engine can fit into the Advanced Tactical Fighter, as is the case today where either engine can fit into the F-16 airplane.

ADVANCED TACTICAL FIGHTER [ATF] ENGINE

Mr. YOUNG. But will the Advanced Tactical Fighter have to be modified in any way to accept either engine? In other words, if the plane was on the tarmac, can you randomly pick either engine and slip it into that airframe?

Dr. COOPER. The Advanced Tactical Fighter will take the brand new engine that is being designed just for it. We will probably down-select to one contractor at some point. There will be one engine involved there. I guess it is not inconceivable there could be two; it depends on how much money we have. The modified engine will go in either the F-15 or 16.

Mr. YOUNG. Okay.

General RANDOLPH. The only point I was making is as we go through our initial design, because we don't know which engine will be selected, we are being sure the design selected will take either.

I-S/A AMPE PROGRAM

Mr. YOUNG. Mr. Secretary, last year you and I worked on a project called I-S/A AMPE and we were successful in promoting the Air Force position on that, although a member of the other body was somewhat critical of our efforts and your efforts. In order to fund that program, we had to agree to rigorous investigation and a review of the procedure that you used in making that contract award. My understanding is that the Inspector General looked into this very thoroughly and has strongly stated that your practices were very much in order and they found nothing wrong. Is that correct?

Dr. COOPER. That is true. I believe that the IG has written to the Chairman, so stating his findings and that the issue, Mr. Young, was as you recall, we had three competitors. We had the option when we went into the competition to pick more than one to go into the next phase. When we actually did the evaluation it turned out that one of the three competitors clearly stood out from the other two. So from a technical view, it was vastly superior.

Not only that, in our judgement the cost to carry a second competitor in the next phase far exceeded any benefit we might get from retaining them in the next phase, so the decision was made to carry one. We had a competition. There has been some misunderstanding. Many of the reports I have seen, assert that the Air Force went sole-source. We did not go sole-source. That competition lasted 18 months. We think we got a tremendous deal from the winning contractor in both the development phase and in the production phase, and there was no benefit to be derived from carrying two into the next phase.

The Inspector General fully confirmed that, and I believe the bottom line was that the Air Force acted in good faith.

Mr. YOUNG. It always feels good to prevail, especially when the argument was as heated as that one. Is that on track now?

Dr. COOPER. It got off to a slow start in the first four or five months because of an inability to clear some of the contractor personnel. It is back on course and we believe it is moving smoothly right now. So it is a 44-month program and therefore, it is too early now to say where we are. Some people have concerns about our ability to build this thing in a secure sort of way. I would acknowledge that is a challenge but we have every expectation that we will do that.

Mr. YOUNG. I noticed the Chairman giving me the signal. I have additional questions I would like to submit for the record.

Mr. DICKS. Without objection.

[CLERK'S NOTE.—Questions submitted by Mr. Young and the answers thereto follow:]

JOINT SURVEILLANCE TARGET ATTACK RADAR SYSTEM [JSTARS]

Question. The Joint Surveillance Target Attack Radar System (Joint STARS) is an Air Force/Army program to field a common radar and attack system. The system consists of both the airborne and ground elements. The airborne element consists of C-18 aircraft (modified Boeing 707s) carrying a radar, operations and control functions and communications equipment.

The newest Soviet SAM (surface-to-air-missile) is referred to as SA-X-12. ———. Testimony earlier this year from the intelligence community, stated that high altitude targets such as AWACS and JSTARS could be engaged by the SA-X-12 at ranges as great as ———. What will be the effective range of the JSTARS radar?

Answer. A Defense Intelligence Agency (DIA) document, the *Defensive Missile Systems Handbook-Eurasian Communist Countries,* September 1985, identifies the maximum range of the SA-X-12 ———. Another DIA document, the *Soviet SA-X-12 Surface to Air Missile System,* July 1984, identifies the max effective intercept range against a target at 38,000 feet as approximately ———.

Question. In your present operational scenario for JSTARS, how far behind the front line will it operate?

Answer. The nominal standoff for the Joint STARS C-18 aircraft is ——— behind the front line. This does not preclude the C-18 from operating either farther from or closer to the front line, as the tactical situation and survivability concerns dictate.

Question. In order to be effective, how near the front line does the Joint STARS aircraft have to operate?

Answer. Joint STARS can provide good data to combat commanders when it is operating as far as ——— from the Forward Line of Own Troops (FLOT). Joint STARS capability does not "fall off a cliff" beyond ——— but the effects of terrain and foliage become much more of a factor.

Question. The Army is developing the ATACMS missile for deep strike against second-echelon Soviet forces. Will ATACMS be the primary weapon system for the moving targets spotted by JSTARS?

Answer. The Army's primary deep fire system for attack of stationary and moving second echelon Soviet targets will be the Army TACMS. JSTARS will provide the corps commander with real time target detection and location at operational depths for employment of the Army TACMS. The Air Force will employ Joint STARS data to effectively utilize tactical aircraft and associated weapons for timely attack of moving targets.

I-S/A AMPE

Question. Secretary Cooper, can you tell us how critical it is for you to have an I-S/A AMPE?

Answer. The I-S/A AMPE system is essential to overcome shortfalls of existing Service/Agency uniquely developed Automated Message Processing exchange programs. These shortfalls, such as the inability to meet class A-1 security certification requirements and area consolidation objectives, are exacerbate by escalating operations and maintenance costs associated with today's aging equipment and the lack of standardization among the current systems. I-S/A AMPE will also provide added capacity and survivability over the current system. DoD-wide standardization of telecommunications support to commend and control, intelligence, and common-user communities is a driving factor in the need for the I-S/A AMPE.

Question. As you know, we had some controversy over the Air Force decision to award a single contract for this program. After last year's mark up of the DoD appropriation's conference report, the IG looked into the matter to determine if the Air Force action was appropriate. It is my understanding that the IG determined that your action was appropriate. Is that your understanding and are you confident that the Air Force acted in good faith?

Answer. Yes, the IG found that the source selection for the I-S/A AMPE program was carried out fairly and properly. I am confident that the Air Force acted in good faith.

Question. Is the I-S/A AMPE program on track?

Answer. Yes, although there have been some internal milestone adjustments. This program is receiving the highest attention from both Air Force and top-level TRW management to assure that we will field an on-schedule, within-cost system for the Department of Defense.

Question. Joint programs in the past have presented serious management problems. Why do you think the Air Force can be successful in this joint program?

Answer. The Air Force has established tight controls on changes that impact cost or schedule in any way. The Air Force, in conjunction with DCA and other Service and Agency representatives, has put together a true team effort to carry forth the I-S/A AMPE Program. The Services and agencies are represented in all aspects of the program from the worker level to the senior review process. The Air Force is working hard to insure this program does not experience the problems other joint programs have faced.

Question. What assurance does the Air Force have that the I-S/A AMPE program will be certified A-1 multi-level secure?

Answer. Certification requirements are well documented and understood. The Air Force has taken steps to minimize certification risks by: (1) maintaining daily exchange with the Certification Authority through the collocated NSA Liaison Office; (2) a Security Certification Working Group to respond to developing issues; (3) closely tracking sub-certification tasks through an automated management system which enables critical path determinations.

PAVE PANTHER/PAVE TIGER RPV PROGRAM

Question. As you know the House Armed Services Committee and this committee have been very supportive of the Pave Panther/Pave Tiger RPV program. Last year the Congress authorized and appropriated $15 million for this program. What actions have the Air Force taken to use Pave Panther/Pave Tiger development and production funds that the Congress has appropriated including previous years?

Answer. The Air Force is currently reviewing alternative methods for using these 1986 funds. These alternatives include a demonstration test of the Pave Tiger weapon ———. The alternative chosen will be limited to development. The Air Force intends to preserve the ability to make a production decision at the end of this effort, but no production funds are planned to be spent.

ENGINE MODEL DERIVATIVE PROGRAM

Question. Your request for the Engine Model Derivative Program and the Alternate Fighter Engine program for FY87 reflects a reduction of some $30.8 million and $67.34 million respectively, in your projected spending profile given the committee last year. In both cases, this year's descriptive summary cites the decision to go with a more moderate increase in thrust as the reason. Are you comfortable that this more "moderate" thrust is going to provide you with an adequate engine?

Answer. Yes. The original program funded a low/moderate risk development program that allowed for the maximum growth in thrust of both engine (32,000 lb thrust class) with a production availability of CY 1992. However, based on the results of an Air Force study, we determined that a more modest growth in engine thrust (29,000 lb thrust class), with earlier availability for production incorporation (CY 1990), would satisfy all the program objectives at the same level of risk.

Question. We have seen the Soviets constantly improving their tactical fighters, and with the introduction of the Mig-29/Fulcrum, they now have a fighter force that is much improved. In view of the Soviet advances in fighter aircraft, are you confident that our engine improvement programs are adequate?

Answer. Yes. The Increased Performance Engine (IPE) program has been structured to support the Tactical Fighter Roadmap to provide higher thrust F100 and F110 engines by 1990 of our F–15/F–16 fighter aircraft. The level of thrust achieved by the F100/F110 IPEs will enable the F–15/F–16 aircraft to meet or exceed the projected threat of the early 1990s.

Question. In view of the reduced funding request, will there be any resultant impact on competition in the next phase of the fighter engine competition? What are you doing to maintain that competition?

Answer. We anticipate no impact to the fighter engine competition as the F100/F110 Increased Performance Engines (IPEs) are phased in. The current F100/F110 Alternate Fighter Engine (AFE) competition has been used as the starting point in creating the IPE aquisition program. The IPE program is structured to increase the thrust of the current F100/F110 AFE engines while maintaining or improving on AFE engine durability and reliability characteristics gained during the current engine competition. In addition, warranties and/or guarantees comparable to the AFE warranties will be required for the IPEs.

[Clerk's note.—End of questions submitted by Mr. Young.]

MIRVING THE MIDGETMAN

Mr. Dicks. Mr. Murtha.

Mr. Murtha. No questions, Mr. Chairman.

Mr. Dicks. Mr. AuCoin.

Mr. AuCoin. Thank you, Mr. Chairman.

Dr. Cooper, it's good to see you, sir.

I understand earlier, before I arrived, I think Congressman Dicks was discussing MIRVing the Midgetman and you made a response roughly along the lines that you could effect cost savings by MIRVing that system.

Dr. Cooper. Right.

Mr. AuCoin. There would be a cost in maneuverability, though.

Dr. Cooper. I quite frankly prefer not to prejudge either one of those statements right at this point. But that is the issue. First, would there be cost saving if we MIRVed it. It seems there would be, because you now have three warheads per missile, with roughly the same number of people taking care of it. So, intuitively, you would think there would be cost savings. Intuitively, you would think there might also be some mobility restrictions but we don't want to prejudge that. What we would like to do is take a good, hard look at it to see if our intuition is right.

SOVIET CAPABILITY

Mr. AuCoin. I wanted to ask a question that sort of bears on that. Most of the material I have makes the assumption that the Soviets would attack such a system as Midgetman with the rather dumb barrage attack. What I am more concerned about is a smart attack by the Soviets against such a system, perhaps using depressed trajectories or a maneuvering warhead arrangement. Against that threat it seems to me it is clear that we need to proliferate the launchers, which would seem to me, to mean that we need smaller numbers of fate MIRVed—it means that by going to smaller numbers of fat MIRVed Midgetmen would be the wrong way to go.

Dr. COOPER. If we accepted that premise that they had the capability to real-time target and know precisely where we are at any one time and target, I would agree with you. I think that is an extremely difficult technical task with the intelligence sensors they need and revisit times to pinpoint precisely at any one time where you are, transmit that information if you are talking about SLBMs to the submarines, retarget the missile and strike.

I would submit to you we don't have the capability to do that.

Mr. DICKS. We don't have anywhere near that capability?

Dr. COOPER. No, sir. And when you talk about how long it would take——

Mr. DICKS. Weeks.

Dr. COOPER [continuing]. You are talking about maybe hours, days, weeks, who knows.

Mr. DICKS. Weeks.

SOVIET COUNTERABILITY

Mr. AUCOIN. That is the Soviet capability today and we don't even have this system today, so we are talking about years and years from now that we will get this system, but we expect its life expectancy to be several years as well. What I am thinking about is whether the Soviets are going to stand pat in terms of their countercapability with cruise missiles and SMBMs; that would be one of the things they would like to improve, I would imagine.

Dr. COOPER. I would grant you that would be a capability they would like to have. But that is not unlike the problem we face when we look at strategic relocatable targets where we would like to prosecute real time a mobile target. That is an extremely difficult task.

Mr. AUCOIN. We would be making their task even more difficult, would we not, if we had larger numbers and smaller targets and smaller missiles?

Dr. COOPER. Yes.

Mr. AUCOIN. And more mobility?

Dr. COOPER. Yes.

Mr. AUCOIN. So any difficulties already there would be compounded by that; you would agree with that?

Dr. COOPER. Yes. Our premise today is, suppose I have this table as my area to roam over. What I would like to do if I want to hide three warheads, say these three cups, I would like to be able to move them around in random fashion so that at one time he doesn't know precisely where they are on this table. So he has to barrage. I could do that if he uses a barrage attack, putting the three together. That is my MIRVed system. If this spread-out system has the same mobility, he still doesn't know at ony one time where I am. And if he is going to get me, he still has to barrage.

Back to your point. If he could pinpoint precisely in real time targeting this would be a less difficult challenge for him. But he doesn't have that capability today. I would submit to you it will be an awfully long time before he or we have it.

Mr. AuCoin. But by using this option you have just left on the table, the three separate ones, you have made it harder regardless of that?

Dr. Cooper. No, sir. If I can maintain this sytem that has three together, totally mobile so he doesn't know where I am at any one time on the table, that is as difficult a task as having the three spread around. He still has to barrage. He has to hit the whole area. There are no pieces under the cup. That is the premise.

General Randolph. His cost to attack is the same.

Dr. Cooper. Same cost.

Mr. Dicks. He has to use the same number of warheads.

Dr. Cooper. Because he had to barrage the whole area. That is the key. Will this system, the mutiple-warhead system be as mobile and able to move as fast and randomly as the three will individually?

Mr. Dicks. If the gentleman will yield further. Didn't you say they will look at this between now and next December in the DSARC?

COST AND MOBILITY OF MULTIPLE WARHEAD SYSTEMS

Dr. Cooper. We are in the process of very intensively looking at cost and mobility of two and three-warhead configurations to see what the mobility implications are. The thing that constrains us are the roads and bridges and the gulleys and all those things. We know that most of the roads will handle 30,000-pound missile. When you get to a bigger missile, you get wider, and some of your roads may be too narrow and some of the bridges may not be strong enough to take it. Those are the sorts of things that we have to look at.

Mr. AuCoin. And you have to consider the size of the transporter.

Dr. Cooper. Yes.

Mr. AuCoin. And more easy detectability.

Suppose the Soviets went to depressed trajectory in a very, very big way, and suppose they were to spend as much on depressed trajectory SLBMs over the next several decades as they have on accurate ICBMs in the last decade; what would happen to our bomber survivability if they were to make that kind of shift in direction in force structure? What would happen to our bombers?

Dr. Cooper. The key now is not just bomber survivability but a combination of ICBM survivability and bomber survivability against the SLBM. Today in some instances perhaps the SLBM could get some of the bombers, but he is not capable, because he doesn't have the accuracy, to get the ICBM. So that gives you a type of warning for your ICBM. You get him off the ground before the Soviets are able to shoot their ICBM at you.

SILO HARDENING

I think we had this discussion last year. One of the beauties of hardening might be—and I am not trying to sell you on that——

Mr. **AuCoin**. I like hardening if you can freeze their accuracy. Hardening really makes sense then.

Dr. **Cooper**. The point is if you harden an ICBM silo, it may not be hard in the long run against the most accurate Soviet ICBM, but an SLBM is not nearly as accurate as an ICBM. So you maintain at least the survivability of the ICBM leg against the depressed trajectory SLBM. That maintains the viability of the triad. Of course, you would have your submarines out there.

A depressed trajectory would reduce the warning time and give us more problems.

General **Randolph**. I really believe the discussion has to center—this is the part that always gives me problems—the discussion has to center on the triad. That is the whole purpose of the triad because if I were sitting in Soviet shoes, and I tried to figure a way to defeat the triad as it exists today and that which we propose in the future, I can't come up with a way. The idea is that the Soviets will all of a sudden attack a certain piece of the triad and apply all of their weapons to that piece of the triad just doesn't make any sense. So you have go to work the problem from——

Mr. **AuCoin**. That is why the Minuteman was probably not as vulnerable as we were led to think for a while.

General **Randolph**. I don't want to second guess the folks who discussed that in the past, but I will say this: If I am sitting on the other side, and I am looking at the Peacekeeper missile from the so-called Soviet Minuteman silos, I don't think I am comfortable about the ability to destroy the Peacekeeper missile.

Mr. **AuCoin**. Or the Minuteman.

General **Randolph**. Or the Minuteman.

ABILITY TO PENETRATE SOVIET DEFENSES

Mr. **AuCoin**. Are you worried about the Soviet SDI, Dr. Cooper?

Dr. **Cooper**. Yes.

Mr. **AuCoin**. How big is our program to counter any Soviet development of an SDI capability?

Dr. **Cooper**. We have an active program in terms of penetration aids for the ICBM, and so on.

Mr. **AuCoin**. How confident are you that that program will be effective?

Dr. **Cooper**. I am confident that against the threat today that our penetration aids are keeping up with that threat. Against an SDI-type threat——

Mr. **AuCoin**. That is what I am talking about.

Dr. **Cooper**. I am less confident in the long term. We would have to come up with new techniques. I think that one of our brightest programs is the ASMS, where we are looking at a variety of penetration aids. First, we look at how we can penetrate the Soviet defenses.

Mr. **AuCoin**. SDI-like defense?

Dr. **Cooper**. Their ABM defense, the defenses they have today, and project that they will have in the near term. I think Red Team activity also helps us to see the sorts of things they might do to us in the SDI world, so there is a push-pull effect there. We believe that a least in the near term through the remainder of this century our ability to penetrate the Soviet defenses is high.

Mr. **AuCoin**. You are talking about point defense?

Dr. **Cooper**. Yes.

SOVIET SPACE-BASED SYSTEM

Mr. **AuCoin**. I am asking you what we are doing in terms of preparing to defeat the Soviet space-based system.

Dr. **Cooper**. Of course you know we have a very vigorous Red Team activity that goes along with our SDI that gives us insight of how that might be defeated.

Mr. **AuCoin**. What are you finding?

Dr. **Cooper**. That I can't comment on. You would have to ask General Abrahamson.

Mr. **AuCoin**. Can you tell us what it entails?

Dr. **Cooper**. I don't have the details.

General **Randolph**. You mean the Red Team activity?

Mr. **AuCoin**. Yes.

General **Randolph**. Of course, the purpose of the Red Team activity under SDI is to try to determine the things that the Soviets might do to counter our SDI effort. I think what Dr. Cooper is saying is that we are just looking at that as a potential in the event that the Soviets develop an SDI effort. But the answer in terms of technology is we really don't have in being today what I would call a vigorous technology program to work against Soviet SDI for one very good reason: We really don't know what the Soviets are doing.

Mr. **AuCoin**. Are we doing anything to assure missile penetrability against a space-based defense on the part of the Soviet Union? Is there any work underway on our side on that at all?

General **Randolph**. There is no technology work to my knowledge going on that is pointed specifically at being able to penetrate a space-based defensive system, and, again, the reason we don't have that is because we really don't know what that system looks like. It's a little difficult for us to begin to respond when we have no information as to what that might do.

Dr. **Cooper**. We are not even sure what ours is going to look like yet. I think in that regard we are probably ahead of the Soviets with the thrust that we have.

ASAT INSTRUMENTED TARGET VEHICLE LAUNCH

Mr. **AuCoin**. Let me ask you one ASAT question to do with the launch of the instrumented target vehicle last year while we were in conference. Why did you have to launch it at that time? How long a wait would it have been before the next launch window?

General **Randolph**. If I remember correctly, it was about two or two and a half months for the next launch window.

Mr. **AuCoin**. Two to two and a half months?

General **Randolph**. Yes, sir. The reason for launching at that time was (a) of course the window, (b) the crews were available at that point, and we just felt that it was prudent to go ahead and make use of the crews, and (c) we had planned the launch based on previous authorization committee approval.

Mr. AuCoin. How many window days would you say there have been since that launch?

General Randolph. The time to launch the target?

Mr. AuCoin. Yes.

General Randolph. Three or four.

Mr. AuCoin. Three or four since then?

General Randolph. Yes.

Mr. AuCoin. Why was it critical to do it then?

General Randolph. Well, there wasn't any——

Mr. AuCoin. You had three or four other occasions.

General Randolph. There wasn't any reason, Mr. AuCoin, at that time.

Mr. AuCoin. Congress was in fact in conference at the time on that, that being one of the outstanding issues.

General Randolph. Yes, sir. But, quite candidly, we did not realize that the issue that eventually came to the forefront was as serious as it obviously was.

Mr. AuCoin. So it was the case that you prejudged congressional outcome?

General Randolph. No, sir, that was the program approved and that was the schedule set, and we proceeded along with the schedule.

Mr. AuCoin. One final question.

Dr. Cooper. Can I just respond to that? We had planned to have two launches during 1986 against the Instrumented Test Vehicles (ITVs). We were optimistic that we would be able to do that. I believe the launch window was in January. If we would not have launched, if we would not have gotten permission to go forward, we would have lost time in the program. That was the judgment. I might point out those ITVs are still available. We think they will be available into next year, so hope springs eternal that from an R&D point of view we would still like to test against the ITVs at some point. We have not deployed them. They are still in their canisters. And the last I checked, we think there is about a year's lifetime in them.

Mr. Dicks. We have another group outside and two more people waiting to ask questions.

FLIGHT VEHICLE TECHNOLOGY

Mr. AuCoin. I will ask a question for the record. It has to do with the flight vehicle technology and advanced fighter integration technology programs. I have had one personal briefing on this and I was very impressed with what I got. I would like to submit a question for the record and have you amplify.

General Randolph. Yes, sir. If you are interested, we would be pleased to come in and talk to you about that.

Mr. AuCoin. I had one briefing already and I would like to get something on the record in response to this.

Now what about the Flight Vehicle Technology and Advanced Fighter Integration Technology programs. I had a briefing on them last year, and I was impressed. Take a few minutes now to run through the components of those programs for us, what you hope to get out of them and what problems you're having.

[The information follows:]

The Flight Vehicle Technology and Advanced Fighter Technology Integration (AFTI) program work together synergistically to produce advanced flight vehicle technologies that are flight demonstrated and ready for transition to fill-scale development. The Flight Vehicle Technology program is responsible for developing subsystems and providing them to the AFTI program for integration and flight demonstration.

The major comonents of these programs in FY 1987 are the AFTI/F-111 Mission Adaptive Wing; Short Take-off and Landing/Maneuver Technology Demonstrator (STOL/MTD) F-15; the X-29 Advanced Technology Demonstrator; Integrated Control/Avionics for Air Superiority (ICAAS); Adaptive Flutter Suppression; Atmospheric Electricity Hazzards Protection; Self Repairing Flight Control System; and the Boost Glide Vehicle.

The AFTI/F-111 Mission Adaptive Wing program will demonstrate the ability to optimally recontour an F-111 wing shape in flight for improved range and flight control. We anticipate that a 30 percent increase in range and a 25 percent improvement in maneuverability can be achieved. We began flight testing the Mission Adaptive Wing in October 1985 and, so far, the wing is performing better than expected.

The STOL/MTD program will provide our fighters with the capability to operate from very short, bomb damaged runways without sacrificing combat capability. This capability will be demonstrated on a modified F-15. The key technology we have to demonstrate is the integration of the flight and propulsion controls with a rectangular engine nozzle capable of thrust vectoring and thrust reversing. Until 1986, problems with weight and cooling prevented us from being able to build these nozzles. However, we believe we have these problems solved now. In addition to the short take-off and landing capability, the vectored thrust propulsion system will give our fighers maneuverability and flight control that outperforms any solely aerodynamically configured aircraft.

As you know, the Air Force has been participating with DARPA and NASA on the X-29 program, which demonstrated many advanced flight vehicle technologies including forward swept wings, discrete variable wing camber, close coupled canards, and three-surface pitch control. The first phase of flight testing will be completed in 1986, at which time the program will transition to the Air Force. With the participation of NASA and DARPA, we intend to modify the X-29 aircraft and begin expanded flight envelope testing. This extended flight test program is necessary to confirm the advantages of these technologies for high angle of attack operation.

The ICAAS program will demonstrate the technologies that will give a small group of our fighters the capability to coordinate an attack against multiple enemy aircraft. This will be done by integrating sensors and fire control systems and by identifying to each pilot which targets are his responsibility. Further, by automatically prioritizing and generating fire control solutions, the pilot's workload will be reduced. This program will help assure victory in air-to-air combat situations in which we are outnumbered.

Some current aircraft must fly slower when attacking a target than we would like because the external weapons they carry can cause aircraft flutter. Flying slower, of course, increases their vulnerability. Our adaptive flutter suppression effort is examining solutions to this problem through the use of motion sensors and software to issue appropriate compensation commands to the aircraft control surfaces. The objective is to increase our survivability by as much as 50 percent over conventional approaches.

The Atmospheric Electricity Hazards Protection program develops design concepts which will protect advanced aircraft from lightning. This will eliminate the overspecification and uncertainty that drives up the life cycle cost of electronic protection methods used on current systems. The resulting design guides will be used in the design of future aircraft.

The Self Repairing Flight Control system uses advanced software to diagnose damage in flight, reconfigure the remaining flight control capability to compensate for the damage, and give the pilot the maximum remaining control capability to either finish the combat mission or to return home. Once home, the system will assist maintenance personnel in fault location and isolation, thus, returning the aircraft to service in a minimum amount of time.

In our Boost Glide Vehicle program we are applying advanced aerodynamics and materials to develop an unmanned hypersonic weapon delivery system. Basic aerodynamic design will be investigated.

ICBM MODERNIZATION

Mr. **AuCoin**. Thank you, Mr. Chairman.

Mr. **Dicks**. Mr. Miller.

Mr. **Miller**. I have just two things I would like to cover with the Secretary and General Randolph. With regard to ICBM modernization, the carry hard basing mode for the MX is a promising one, and it might be one of the most cost-effective ones. Can you tell us about carry hard and whether it would be advisable? As I understand it the missile wall itself would be heavier and you would not need to reinforce the silo as much.

Dr. **Cooper**. And carry the hardness with the missile. Yes, that is a promising concept, and it is one of eight that we are currently looking at. We have not made a final judgment as to what our preferred basing mode would be, but that is one the priority list now.

General Randolph, you might want to comment further.

There are a number of things you could do. You could put it in a soft silo or have more silos than you do missiles and add deception with it. So you have mobility, deception, and hardness.

General **Randolph**. The promising part about it is if you can build the silos cheaply—and we are trying to figure out what "cheaply" is. But if you can build the silos cheaply and move the missile around in a deceptive fashion from one silo to the other, carrying again the hardness with it, it is in fact a form of mobility and it does not require that large investment in the silos and therefore you can afford to build many silos and therefore effectively have precisely this same business of the are that the Soviets would have to barrage in orde to interdict those missiles.

Whether all that will work is something that needs to be studied and determined.

CARRY HARD BASING MODE

Mr. **Miller**. If you have the heavy wall on the carry hard then would you need additional thrust; is that one of the possible problems why it is not being pushed?

General **Randolph**. No, sir, you wouldn't launch that part. In fact, we are working it very hard. But as I said, the real question here is can you build the silo—the part that is the low-cost part—cheaply enough so you can build those in numbers and be able to avoid any detection mechanisms that the Soviets might have whereby they could identify where the missile is located at any given time.

Those are the two big issues that we have to resolve. Given that we can do those things, at a reasonable cost, that might indeed turn out to be an approach that makes some sense. But we are continuing to work it very hard.

Mr. **Miller**. Very hurriedly, if you could throw on the next to the last chart, which was a series of charts. You showed the ICBMs and the Peacekeeper separately. There was quite a volume of dollars there.

General **Randolph**. Yes, sir.

Mr. **Miller**. For the total ICBM force. Can you explain why we would have such an extreme amount? Was that modernization of the MX before we really get started on it or what?

Dr. **Cooper**. While he is looking for that, I wanted to clarify something that caught my ear. On the carry hard, what you carry around with the missile is a cylinder, cocoon that encloses the missile that is hard. When you launch the missile you don't launch that cocoon with it. It would be a missile inside a structure, a cylinder.

Mr. **Miller**. It is not the wall of the missile?

Dr. **Cooper**. No, sir.

Mr. **Miller**. It would be a shell around the missile.

Dr. **Cooper**. It would be the cylinder with the missile in it.

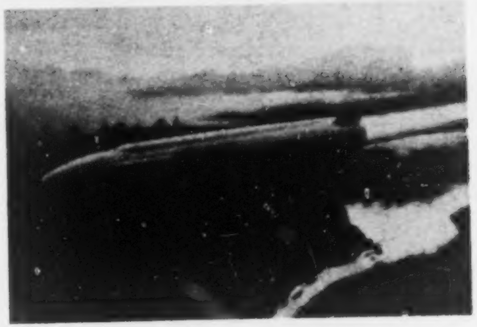
Mr. **Miller**. The shell with the missile inside.

Dr. **Cooper**. When you launch, the missile launches out from under that shell.

[Slide follows:]

STRATEGIC OFFENSE

		FY 1987 ($ IN MILLIONS)
ICBM LEG		
• ICBM MODERNIZATION		2117
SMALL ICBM	1376	
ADVANCED BASING TECH	389	
PEACEKEEPER	352	
• ADVANCED STRAT MISSILE SYS		177
• MINUTEMAN SQUADRONS		68
BOMBER LEG		
• SHORT RANGE ATTACK MISSILE II		165
• B-1B		119
• PROTECTIVE SYSTEMS		93
• COMMON STRAT ROTARY LAUNCHER		15
• STRAT/CONV STANDOFF CAPABILITY		7
• AIR LAUNCHED CRUISE MISSILE		6



COST OF DEVELOPMENT

General **Randolph**. The monies you referred to are here. This is for the development of the smaller ICBM $1376 million. This is the money that goes into developing whatever basing mode is selected or one or two basing modes. ($389 M). This is development money for the basing mode for Peacekeeper. This is not for the small ICBM. This is the number having to do with completion of the Peacekeeper program $352 million. There are a number of tests to be done. For example, we have to launch the Peacekeeper using the airborn launch control center. We have got launch control work in there, so that is the purpose of the dollars we are asking for.

Mr. **Miller**. Between the two you would have $730 million or some such figure?

General **Randolph**. Yes, sir, that is correct.

Mr. **Miller**. Thank you.

General **Randolph**. That is a lot of money.

MISSILE SPARES

Mr. **Dicks**. How many spares will we have on that?

Dr. **Cooper**. 123. Those are for operational flight tests and surveillance. 108 are for test launch purposes and 15 of those 123 are for aging surveillance.

DEEP BASING MODE

Mr. **Chappell**. Will the gentleman yield a moment? Is deep basing still under consideration?

General **Randolph**. Yes, sir. One of the modes we are looking at is deep basing. Let me tell you a problem with the deep underground. The ICBM leg of the triad, its job is prompt retaliation. If you are based deep underground, you lose that. It takes a while to get that up to the point that you can launch it. That is one of the biggest penalties against the deep underground. No doubt it will survive, but the issue is being able to launch properly.

Dr. **Cooper**. You might want to put a few of the missiles in a mode like that as a secure reserve force where you didn't need the prompt retaliatory capability.

Mr. **Dicks**. Mr. Livingston.

COFFERDAM DESIGN EXPERIMENTAL EFFORT

Mr. **Livingston**. You talk about the possibility of hardening silos cheaply. Last year the Congress provided $15 million for an expermental effort related to ICBM silo survivability. The funds were to be used to construct and test the structure of a double wall cofferdam design. I have talked with General May and his director of ICBM modernization and they have been cooperative and helpful and I appreciate their efforts. But this committee directed that a contract for such an effort be entered into not later than March 1, 1986. I don't think that has been done, but can you tell me if such a contract has been awarded?

General **Randolph**. The contract has not been awarded. We have put part of the $15 million we have been given to the Defense Nuclear Agency. They are now designing the test. We are doing sub-scale systems and designs and will do sub-scale testing to make sure when we do the full-scale test that it is the right configuration. We could not get it all together by the first of March. That was the problem.

Mr. LIVINGSTON. I was under the impression that either the Air Force or DNA has been reluctant to go to full-sized testing. Is that not true, and when do you think we might get around to going to full-scale testing?

General RANDOLPH. I would say not reluctant but a little conservative to make sure when we do go to full-scale testing that we have the right article to test. That is the reason we are doing the sub-scale work before doing the full-scale. For example, one of the issues is the amount of free space between the walls of the cofferdam, how big that should be. I recognize that constructability can only be tested under a full-scale test, but we want to be sure we have the right design parameters before entering into a test.

Mr. LIVINGSTON. I am informed that the gentleman with whom you are contracting on this thing was out at Tyndall Air Force Base looking for his previous figures and data on prior tests done on his own models, and was instructed, don't worry about the old data, go ahead and work new stuff.

Isn't that duplicating some unnecessary experiments?

General RANDOLPH. Mr. Livingston, I am not specifically aware of the situation that you are taking about, but I will be pleased to look into that and report back to you. The description that you have made does sound like reinventing the wheel, and we don't want to do that.

ROLE OF DEFENSE NUCLEAR AGENCY

Mr. LIVINGSTON. At this point the Air Force has been designated as the planning and management agent for this contract. Could you just briefly explain what the involvement of the Defense Nuclear Agency is and whether or not they have been helpful and responsive in this instance?

General RANDOLPH. DNA has been most helpful and responsive in working with us. They have actually done the hands-on work to date and in fact they money that we have spent to date has been spent through the good offices of the Defense Nuclear Agency, so they are working with us, doing basically the work for us under our guidance, and they have indeed been most helpful.

PRECISION LOCATION STRIKE SYSTEM

Mr. LIVINGSTON. I would like to continue to work with you on that subject. With respect to the PLSS, I understand it is the Air Force's contention that the program has not progressed as rapidly as everybody had hoped and anticipated and that it may be scrubbed this year, but I can tell you that from my service on another committee, that Don Latham, the Under Secretary of Defense for C^3, has contrary views on that and is very high on this program. Could you tell me your evaluation? I understand that it has been zeroed out. How do we correlate the position of the Air Force with that of Mr. Latham?

General **Randolph**. Mr. Livingston, the Air Force has not yet made a final decision on which way we are going to go with that program. I wil have to say, however, that the program today is some three years behing schedule. We have had a very, very difficult time getting the in-the-air-data that we need to move the program forward. We recently have begun collecting the data and as we have reviewed the program, looked at the data and determined what is necessary to achieve the objectives that we set out earlier to do, it becomes clear to us now that it is going to take much more money than we had originally planned. In view of the difficult financial situation that exists, we think that it is going to be very painful for us to come back to you and start asking for more money, so we are looking at that very hard because of the lack of technical progress and the protections of increased costs.

DECISIONS TO TERMINATE PROGRAM

Mr. **Livingston**. Will the decision be reached on the basis of any interchange with OSD?

General **Randolph**. Absolutely.

Mr. **Livingston**. So the ultimate decision wil be in joint agreement——

Dr. **Cooper**. The Defense Resources Board will make the ultimate decision. All of these would be proposals from the services. There are a lot of things on the table that are kind of painful in view of the budget constraints.

Mr. **Livingston**. Thank you. Thank you, Mr. Chairman.

NATIONAL AEROSPACE PLANE PROGRAM

Mr. **Dicks**. We will have some questions for the record.

Just one final question. Tell us a litle about the Orient Express.

Dr. **Cooper**. How about if we show you a model of it?

General **Randolph**. Let me just talk a little about it. We have a three-phase program. Phase 1 has already been completed and that is just a look at the basic technology. What we learned in Phase 1 is the following: The ramjet propulsion technology is moving along quite well. This is one of the models. Secondly, the computer technology data that we need to design such an airplane is now present, and thirdly, the kinds of materials necessary to have on a machine that can move up to Mach 25 in the upper reaches of the atmosphere are now present. So we then moved into Phase two. We are in Phase 2 today. On Monday, we let seven contracts, five to airframe developers and two to propulsion houses, G.E. and Pratt & Whitney, and we will go through Phase 2 over the next three years, completing that in 1989.

Given that we achieve succcess in that phase, we will move to Phase 3, which is to develop an experimental flying machine that would fly sometime in the '90s timeframe.

R&D REQUEST

Mr. **McDade**. What money are you using, R&D accounts?

General **Randolph**. Yes sir. This is purely R&D accounts.

Mr. **McDade**. What year?

General **Randolph**. We have in fiscal year 1987 a request for the Air Force for $34 million.

Mr. **McDade**. You have a request, but you are telling us you are entering into a contract.

General **Randolph**. Yes, sir, we already have R&D money in fiscal year 1986.

Mr. **McDade**. What program are you taking it out of?

General **Randolph**. It remains experimental. We are not asking you to approve that as an entity, we are asking for you to approve money for research, $34 million in 1987.

Mr. **McDade**. How much in 1986?

General **Randolph**. For the Air Force. For the Air Force in 1986 it is $11 million. Now I should point out that NASA is a participant. Eighty percent of the money is DOD money, 20 percent is NASA money, and within the DOD the Navy, the Air Force DARPA and the SDI, because of the potential for use in the SDI activity, are all contributing money, but it is all research money to do this kind of work.

TOTAL FY 86 ALLOCATION

Mr. **McDade**. What is the total 1986 money an the total expected in 1987?

General **Randolph**. The total expected in 1987 is—and I think if you will bear with me for a second I will give you that information——

Dr. **Cooper**. Your question is that you didn't know about this in 1986; where is the money coming from. It is technology money on propulsion and structures. That is the question, under what line was the money allocated in 1986.

Mr. **McDade**. Tell us exactly what funds you took it out of fiscal year 1986.

General **Randolph**. In fiscal year 1986 it was $10 million. The total amount of money in fiscal year 1986 of all of the agencies involved is $61 million. In fiscal year 1987 the total request of all agencies involved is $212 million.

Mr. **McDade**. Where did the $10 million come from, what account?

General **Randolph**. The only thing—here it is. I am sorry. Program element number is 63269, and that program element is addressing basic technologies in airframe and propulsion areas, so it is technology money.

Dr. **Cooper**. DARPA was doing work in this area as well in the Black arena, you remember the Copper Canyon, which we made public six or eight months ago. The interesting thing about this, Mr. Dicks, is that it can take off from a runway like an airplane, break the surly bonds and reach Mach 25 and become a spaceship, orbit the earth and then land like an aircraft, so it has both the characteristics of an airplane and a spacecraft.

NATIONAL AEROSPACE PLANE MISSION

Mr. **Dicks**. What is its military mission?

General **Randolph**. It can have a variety of military applications. It could be a ———. We haven't focused on the particular mission yet. It is still a technology program.

Mr. **Young**. Could it put satellites in orbit?

General **Randolph**. Yes. That is one of the important potential uses of the machine and the initial expectation is that we can put satellites into orbit for a cost that is an order of magnitude less than the cost to do it today.

PAYLOAD-TO-WEIGHT CAPABILITY

Mr. **Young**. What about payload?

Dr. **Cooper**. That is the point, the payload-to-weight capability of this aircraft far exceeds anything we have ever built.

General **Randolph**. Let me just tell you the theory and the reason for doing the research and experimentation. The theory is that we carry the hydrogen on the airplane. On the shuttle, one of the gigantic problems is carrying the oxygen. if you could put together an engine such as a ramjet that can use the oxygen from the atmosphere until you get into orbit, you have saved a considerable amount of weight-carrying which is inefficient. That ramjet technology is here to allow us to use the oxygen from the air, carry the hydrogen with us and be able to get the propulsion. Will that happen? We don't know, but if it does, it is a major leap forward in the technolgoy.

Dr. **Cooper**. There are three areas that we are looking at in detail: propulsion, structures, lightweight structures and also the computation of fluid dynamics of the flow fields around that vehicle and into that propulsion system. This is somewhat in the same phase as SDI right now. It is technology that we are looking at. If that proves out, we will move to the next phase where we build the next vehicle. If that proves out ultimately prerhaps we will be able to get it operational.

LANDING CAPABILITY

Mr. **Chappell**. What kind of landing space does it take?

General **Randolph**. The theory is it would land pretty much as a normal airplane. For example, landing a shuttle is an adventure, in my book, but this is designed to land as a normal airplane.

Dr. **Cooper**. We would probably start out using the Mojave Desert.

Mr. **Dicks**. Is this going to be stealthy?

General **Randolph**. No, sir. This is purely experimental and we don't know where we are going to go, given that it is an experiment to see if we can get there.

Mr. **Dicks**. I have several questions I would like you to answer for the record.

[**Clerk's note**.—Questions submitted by Mr. Dicks and the answers thereto follow:]

ANTI-SATELLITE TEST PROGRAM

Question. The Department of Defense has indicated that it will comply with Congressional direction prohibiting the testing of the anti-satellite weapon against an object in space, so long as the Soviets show similar restraint. In light of that and cost and schedule problems that the program has encountered, the program has been approved for restructuring. Under the restructured program, what is the test program planned for Fiscal Year 1986? When would such IR probes take place? What valuable information would you learn from these tests?

Answer. The Secretary of Defense approved on 31 Mar 1986, an Air Force proposal to conduct two infrared phenomenology tests against the radiation of a star in FY 1986. ———. Further, from these tests we will be able to determine system performance at the lower altitudes of our operational envelope, and obtain additional statistical data with which to assess system reliability/availability.

Question. In Fiscal Year 1986 the Congress deleted requested procurement funds for this program, and transferred them to the research and development effort. How do you plan to utilize these funds? Will you be submitting a reprogramming to the Congress as a result of this restructuring? If so, what will it include and when will it be submitted?

Answer. We had intended to use the $15 million of RDT&E funds transferred from the procurement account for the Production Verification (PV) effort. PV was the result of an independent review conducted last year and several previous recommendations by Congress. Under PV, we are implementing changes/upgrades to make the system more producible, supportable, and operable. We had developed our FY 1986 activities assuming that this additional $15 million would be available and had started the PV effort. However, in late March 1986, the HASC stated that they do not intend to authorize the additional amount. We are in the process of reevaluating our options, which include termination of the PV tasks, should the $15 million not be authorized.

We are not submitting a reprogramming action to Congress as a result of the program's restructure.

Question. ———. What does this reduction in acquisition do for the military significance of the program and its ability to meet the originally assigned threat?

Answer. ———.

Question. Cost growth has been an issue in this program. A recent GAO report indicates that costs have grown from $3.5 billion to $5.3 billion. Others have contended that this overstates the growth. What are your figures both for the program overall and per missile. At this point aren't we talking about well over $100 million per missile?

Answer. The current cost estimate for the overall program is $3835.7 million, as documented in the December 1985 Comprehensive Selected Acquisition Report (SAR). There are two commonly accepted methods for calculating missile unit cost. The first method is the Program Acquisition Unit Cost (PAUC), which is the total acquisition costs (RDT&E, procurement, military construction) divided by the total number of units (for ASAT—this is the number of missiles, both development and procurement). The second method is the Procurement Unit Cost (PUC), which is obtained by dividing the total missile procurement costs by the number of production missiles. ———.

ASAT—WHERE DO WE GO FROM HERE?

Question. The Chairman of the House Armed Services Committee has called for terminating the ASAT program in a statement entitled "This ASAT is a Bummer."

He argues that the real debate should focus on more advanced concepts that are being developed under the SDI program that have both greater potential capabilities and complications for strategic stability.

If the Congress provided no funds in Fiscal Year 1987 for this program, would Air Force press for greater attention to potential ASAT applications for programs being exploded by SDI?

Answer. If no funds were provided in FY 1987 or the ASAT program, we would have to conduct a complete reevaluation to assess available options. For your information, the present ASAT program has been restructured into two phases and is currently evaluating advanced concepts such as those being developed under SDI. Under the first phase, we will procure sufficient missiles to negate the near-term threat. In the first phase, we are also monitoring/evaluating promising technology efforts, ———. We plan to make a decision on the force structure for the second phase in the early 1990's. This ASAT force structure may consist of additional air-launched missiles and/or other technologies. We believe this approach is the most prudent since it will provide the only near-term ASAT capability available while taking maximum advantage of any new, potentially more effective, less costly technologies. Our current estimate is that the SDI technologies can probably be accelerated if DOD-requested funding levels are increased and appropriated. Even so, these technologies will not be responsive to the near-term threat, and their acceleration in lieu of the demonstrated air-launched ASAT would be questionable. Without increased funding, SDI technologies will not be mature enough for operational deployment ———. Consequently, although a detailed review has not been performed, we would probably not press for greater attention over that currently being expended for SDI efforts.

Question. Would you reexamine alternative methods of providing increased satellite survivability including hardening, maneuverability, or redundant assets?

Answer. We currently have many on-going/planned satellite survivability efforts. Some operational satellite systems today employ radiation hardening, on-orbit sparing, anti-jam communications, and attack detection sensors to increase survivability. New satellites, currently in development, will employ these features ———. It should be noted that adding survivability is not cheap. Estimates range up to a 30–40 percent increase in cost per satellite for survivability enhancements. If the ASAT program is not funded in FY 1987, we would probably conduct a reevaluation of the survivability program. We potentially would make changes which could, in the long term, increase survivability and may help to counter the Soviet ASAT threat. However, these changes would not provide a deterrence or counterforce capability. The Soviets would be still free to attack our critical space assets without fear of reprisal. In addition, we would be unable, in time of crisis, to negate the Soviet satellites which provide real-time targeting information on our military forces and significantly increase the capability of their numerically superior military forces.

Question. Would you propose a new ASAT program based on different more advanced technologies?

Answer. The present US ASAT program was pursued based on extensive analyses of potential ASAT technologies and has been restructured to reduce missile quantity from ——— for the near-term threat and utilize different, more advanced technologies, such as the ground-based laser, in its second phase should these efforts mature as anticipated. A decision on the second phase force structure is planned for ———.

Question. Based on your best information, when might alternative ASAT approaches be ready for deployment?

If the Congress were to provide some research and development funds for this program in FY 87, but decide to continue the moratorium on testing against an object in space, what would be the Air Force plan for how to proceed? What funds would be needed to accomplish this?

Answer. Our current estimate is that alternative technologies, such as the ground-based laser, would not be available for operational deployment ———.

If Congress continued the moratorium on testing against an object in space, the Air Force would have to conduct a major reassessment to determine whether or not the program should be continued. With this restriction, the development program would be essentially placed in a "hold" mode, expending $10–15 million per month to keep the experienced team together. We are, however, not comfortable with spending this amount of money in this time of severe fiscal constraint to merely maintain the "status quo".

ASAT AND ARMS CONTROL

Question. As you know, those of us who have supported the moratorium on testing of an ASAT system against an object in space so long as the Soviets demonstrate similar restraint, have done so because of arms control concerns as well as over concerns over what ASAT proliferation would mean to the survivability of our satellites and for SDI.

The desire was to create a pause in ASAT development on both sides while we discussed just what role they will play in the future and how we can best project our strategic warning assets.

The effort has been complicated by the unwillingness of the Administration to consider any proposals for ASAT agreements. This includes not just a ban, but also a limitation to low altitude systems such as the existing Soviet program and the MHV/F-15, and even a rules of the road arrangement patterned along the lines of the incidents at sea agreement.

Has the Air Force done any analysis of the implications of possible ASAT arms control regimes? In particular, have you looked at either the low altitude limitation or the rules of the road option? What implications would such agreements have on the MHV/F-15 system or any more advanced systems now being explored by the Air Force or others in DoD?

My own view is that until there is some consideration of these options and discussions with the Soviets, the Congress will continue to impose the current moratorium.

Dr. COOPER. The U.S. National Space Policy, announced by the President July 4, 1982 is consistent with the longstanding U.S. approach to space arms control. It states: "The United States will continue to study space arms control options. The United States will consider verifiable and equitable arms control measures that would ban or otherwise limit testing and deployment of specific weapon systems, should those measures be compatible with United States national security."

This policy, which has been formally communicated to the Congress on other occasions, continues to receive our support.

The ASAT Interagency Group, of which the Air Force is one participant, has actively studied various space arms control options over the past several years. We have looked specifically at the "incidents in space" approach you mention, and we have closely examined the plausibility of agreements that would limit each side to existing ASAT interceptors. Our objective has been to determine if these or any other space arms control options are consistent with Presidential guidance: i.e., equitable, verifiable, and compatible with U.S. national security interests.

The fact that we have not yet achieved agreements does not signify our willingness to consider serious proposals for space arms control. We are gravely concerned about the current imbalance caused by the operational Soviet ASAT system. Arms control that restricts us in our effort to correct this imbalance would in fact pose great potential harm to national security—thus defeating the purpose of both our ASAT program and our arms control policy.

SILO HARDENING

Question. I am advised that recent studies by the Defense Nuclear Agency indicate that previous estimates on the size of the crater from a nuclear blast may have been substantially overstated. Is this correct, and if so, what implications does it have for the survivability of a missile force based in superhard silos?

Answer. Recent DNA studies do indicate that nuclear weapon craters are smaller than originally believed. These studies are supported by an exhaustive reevaluation of the Pacific crater data base and cratering and related effects tests completed in 1985.

These results have verified that considerably smaller nuclear craters and ground motions can now be expected, particularly for dry geology. The implications of these findings are that superhard silos sited in favorable geology are much more robust than previously estimated. We now believe that such silos can survive ground motions and overpressures at least up to the crater's edge. Since crater sizes are now believed smaller than previously forecast, very precise missile accuracies are required to "crater" a silo; ———.

Question. What are our best estimates on when the Soviets might achieve accuracies sufficient to place a missile silo in the crater of an explosion based on this new estimate of crater size?

Answer. ———.

Question. What should be the cost of converting existing Minuteman missiles or M–X scheduled for deployment in Minuteman silos to a superhardened basing mode?

Answer. The Air Force can harden 50 Minuteman silos to ten times existing hardness for about $4.9 B (FY 82 $). The total cost to deploy 50 Peacekeepers in existing Minuteman silos and 50 in hardened Minuteman silos is $21 B (FY 82 $). The costs of deploying 50 Peacekeepers in existing Minuteman silos and 50 additional missiles in new, superhardened (about 25–40 times existing hardness) is $21.8 B (FY 82 $).

SMALL ICBM/COST TO ATTACK

Question. The Air Force has conducted a detailed price to attack study of the small ICBM program. That study, as I understand it, confirmed that the small missile will in fact extract an extremely high price to attack in either the baseline hard mobile launcher mode or in the Minuteman co-location mode.

Please provide for the record a detailed summation of the conclusions of this study. In general terms, what did the study show on SICM survivability?

[CLERK'S NOTE.—The Department's response was provided too late to be printed in this hearing volume.]

Question. Is there a positive relationship between existing ICBM programs and the small missile which will enhance the survivability of each by complicating the task of the Soviet planner? Do you consider the small missile to be a complement to existing systems as opposed to a competitor?

Answer. The Small ICBM's contribution to the survivability of U.S. strategic forces must be examined in the context of the entire TRIAD. To attain their war aims, the Soviets must simultaneously and successfully attack the entire U.S. TRIAD which aids deterrence in two ways. First, the Soviet planner faces an attack timing dilemma: due to the different times-of-flight for Soviet forces, any attack optimized against one leg of the U.S. TRIAD will provide timely warning to the other two legs, permitting the U.S. time to take appropriate action.

Second, a balanced TRIAD prevents any major advance in Soviet research development, which might threaten the effectiveness of one TRIAD leg (e.g., anti-submarine warfare, ballistic missile defense, air defense improvements, silo hardening), from negating the effectiveness of the other two legs. Thus, our bombers, ICBMs, and SLBMs are more survivable and effective in concert than in isolation.

The ICBM leg of the TRIAD provides a prompt capability to hold at risk the most valued Soviet assets. The SICBM will add survivability and endurance to this capability. Therefore, SICBM is a complement to both existing ICBM systems and to the entire TRIAD.

Question. Does the fact that the small ICBM is designed to carry only a single warhead, provide disincentives to a Soviet planner since he would have to allocate a larger number of warheads for each one destroyed? Would this characteristic be particularly valuable in an arms control regime that limited overall warhead numbers on each side?

[CLERK'S NOTE.—The Department's response was provided too late to be printed in this hearing volume.]

SICBM—COST

Question. There has been considerable concern with the cost of the SICBM. Based on your studies, how does the small missile compare to Minuteman and M-X in existing silos in terms of cost per survivable warhead, given the assumption that we would ride out a first strike? What efforts are underway to reduce the investment and operational cost of this program?

Answer. Riding out an attack is considered unrealistic. ———. As the Scowcroft Report points out, the Soviets simply cannot assume we will refrain from conducting a launch after confirmed detonations on U.S. soil. It is this uncertainty combined with the ICBMs prompt capability against hardened targets that reduces the likelihood the Soviets would ever attempt such an attack in the first place.

The cost of acquiring small missile warheads is a little more than twice that of acquiring Peacekeeper warheads. The cost per surviving warhead is heavily dependent on the type of attack scenario being considered and the force mix of ICBMs fielded. However, our analysis indicates that the Small ICBM system offers outstanding survivability and has a very low cost per surviving warhead against a range of creditable attack scenarios.

We plan to acquire and operate the Small ICBM at the least cost possible. For example, several innovative mobile basing variations are under study to reduce both operating and acquisition cost. Operating costs are being lowered through analysis of optimum ways of maintaining the system on a day-to-day basis. Where machinery and technology can take the place of manpower we will invest the necessary money to lower our life cycle costs. Acquisition costs estimates are being verified by an Independent Cost Analysis conducted by the Air Force. Further cost reductions are likely as trade studies come to fruition.

SMALL MISSILE

Question. I understand that there have been very positive results over the last year in development of the small missile including successful full scale motor firings which demonstrated the performance feasibility of high energy propellants, and burst tests that demonstrated the feasibility of lightweight, high-strength motor cases. Could you describe the significance of these tests and what you hope to demonstrate as you proceed to full scale development in the coming year?

Answer. The pre-full scale development (pre-FSD) program for the Small ICBM was initiated to validate the higher risk technical challenges of the Small ICBM program prior to entering full scale development. In this regard, the Air Force has successfully fired rocket motors for all three stages of the small ICBM, validating high energy propellants and new motor technology; bench tested and sled tested our competing guidance systems; subjected onesixth scale models of hard mobile launchers to blast testing; and mobility test vehicles (facsimile HML mobility test beds) have exceeded Air Force requirements on all four test courses. The main significance of this validation program is overall program technical risk reduction; the Air Force is confident of our technical ability to develop and deploy a small ICBM in hard mobile launchers to meet the 1992 IOC.

Question. There are two competing hardened mobile launcher candidates now in competition. How have these candidates performed? Do you expect them to meet system requirements? When will a decision be made on the winning contractor? What criteria will be used to determine the winner?

Answer. There are two competing contractors who have designed Hard Mobile Launcher candidates for the Air Force. Martin Marietta, teamed with Caterpillar, is proposing one design while Boeing, teamed with Goodyear, is proposing a second design. Both candidates are performing well in areas of technical design, testing, and projected system performance. They have evaluated hardness, mobility, and physical security delay denial, and other technical aspects of the program. The Air Force is pleased with the results to date of the on-going competition; both contractors should be able to propose designs which meet or exceed Air Force requirements.

The selection for the winning design is expected to occur in October or November of 1986. The criteria used will include: past performance of the contractor in this program, the technical soundness of each proposal, and the proposed costs of their designs.

Question. The Congress has imposed a weight restriction on the small ICBM of 33,000 pounds. Some have suggested that we increase the weight limit to 37,000-40,000 pounds, in order to accommodate the addition of penetration aids and still maintain range requirements. What is your view on this issue? Would penetration aids delay the IOC of the system? What hedge would they provide against Soviet ABM efforts?

[CLERK'S NOTE.—The Department's response was provided too late was unable to provide a response in time to be printed in this hearing volume.]

Question. Would this increase in missile weight require a redesign of either the missile or the hardened mobile launcher? Some have suggested much greater increases to between 60,000 and 80,000 pounds. Would this require redesign, and if so how long would it delay the program? What would be the impact on system mobility of such a change?

Answer. An increase in weight of the Small ICBM from 30,000 lbs to 37,000 lbs requires minor design modification of the missile and the Hard Mobile Launcher (HML). The first stage of the missile would have to be lengthened by approximately five feet while the missile diameter (46") and other stages would remain unchanged. The HML would have to be lengthened by 5 feet to accommodate the length of the first stage, but the rest of the HML would remain unchanged. This modification would have no schedule impact. Weight increases to the missile, in the 60,000 to 80,000 pound class, require complete redesign of the missile, providing new diameters of 58"-64" and length increases of up to 15 feet for the missile. The Hard Mobile Launcher would require a complete redesign to accommodate the added width/length and weight of such new missile configurations. Such a redesign would add an additional two years to the development schedule. Mobility impacts of heavier vehicles will be studied this summer, with results expected before November 1986.

SMALL ICBM BASING MODES

Question. The Air Force is presently considering three alternative basing modes for the small ICBM, hardened mobile launcher, hardened silo, and hardened mobile launcher on Minuteman sites. Please discuss in brief the advantages and disadvantages you see to each of these alternative basing modes.

Answer. The Hard Mobile Launcher-in Random Movement mode involves the use of hardened, missile-carrying mobile vehicles dispersed over government-controlled access land. Survivability of the system is a function of both launcher hardness and mobility. With strategic and/or tactical warning, the price to attack can be increased by permitting the vehicles to dash to additional areas on base, and if need, beyond installation confines.

The Hard Mobile Launcher on Minuteman Facilities is a variant of the first mode wherein the vehicles are parked at existing Minuteman facilities ready for dispersal in time of national emergency. The survivability of the system in this mode is a function of system hardness, the dispersed nature of the existing facilities, and the resulting capability to rapidly disperse over a large area, thus providing launcher location uncertainty. Again, with strategic and/or tactical warning, the price to attack increases beyond that associated with the first mode in a relatively short period of time. As compared with the random movement concept, this mode would require less manpower and investment cost as a result of it being integrated into existing ICBM operations at Strategic Air Command installations.

The third mode, Hard Silo in Patterned Array, consists of missiles deployed in silos possessing a hardness more than 40 times that of existing Minuteman silos. The survivability of the system in this mode is a function of silo hardness and positioning. The silos are arranged to complicate enemy attack effectiveness while simplifying maintenance, security, and command and control activities. This mode has a higher investment cost, but lower operational expense than either of the other two deployment concepts.

Question. Which alternative would require the least investment cost? The lowest operations cost?

Answer. The lowest acquisition and operations costs to deploy another 50 Peacekeepers is for existing Minuteman silos. Another 50 could be deployed for just $700–800 M more than the existing $16.1 B cost (FY 82 $). Program operating costs would be $62 M per year (FY 82 $).

The next lowest acquisition cost to deploy 50 more Peacekeepers is for hardened Minuteman silo deployment. This mode would cost an additional $4.9 B (FY 82 $) and cost an additional $66 M (FY 82 $) per year to operate.

Question. Which alternative would have the fewest environmental problems? Which the most?

Answer. Environmental studies on the three basing modes and the 24 candidate installations were initiated on 4 March 1986. The Legislative Environmental Impact Statement (EIS) that is to be completed in October 1986 and is intended to provide the answers to these questions.

Question. Which alternative would minimize the problem of competing uses for the military installations? Which would have the greatest problem?

Answer. Studies are presently underway to determine the answers to these questions by late 1986 when basing mode and deployment area selections are to be made. However, from data currently available, each mode offers some unque mission conflict characteristics.

Hard Mobil Launcher in Random Movement—This mode requires the use of the most land, and for that reason, it holds the potential of interfering with the greatest number of existing activities. At the same time, however, the ability of the launcher to be moved from time to time permits its location to be changed in order to avoid conflicting events and uses. We are confident that same areas can be described for small missile deployments without adversely affecting ongoing missions. Continuing analysis is needed to determine the amount of land, and number of installations, that can be used by the small missile in a compatible way.

Hard Mobile Launcher on Minuteman Facilities—This mode used existing land that is already dedicated to ICBM use. While a Minuteman missile remains ready in its silo, there appears to be minimal impact with existing activities as a result of having a Hard Mobile Launcher parked nearby on alert. It would be relatively easy to integrate the small missile mission into ongoing operations associated with Minuteman.

Hard Silo in Patterned Array—This mode offers minimal interference in that the silo arrays are to be located in areas presently not in use.

Question. Which alternative would provide the greatest survivability; which the least?

Answer. For a surprise attack, the Hard Mobile Launcher in Random Movement basing mode offers greater survivability than any garrison or parked-vehicle concept. Given tactical warning and approximately 10 to 20 minutes to dash outward from a parked position, however, the Hard Mobile Launcher on Minuteman Facilities mode offers the greatest survivability. This feature necessarily follows as a result of mobile launchers being deployed at more dispersed locations, and being able to generate new area by traveling in any direction. With any reasonable assumptions concerning Soviet missile accuracy, silo hardness and the effects of fratricide, the Hard Silo in Patterned Array offers a very high degree of survivability. As missile accuracies improve in time, the survivability of hard silos may be adversely affected, whereas that of the mobile basing concepts is not. It is unlikely the Soviets can achieve levels of accuracy necessary to effectively threaten hard silos or have confidence in an attack so dependent on extreme levels of accuracy.

Question. Which alternative would require the least strategic or tactical warning?

Answer. The Hard Mobile Launcher in random movement (on large areas of government land) and the hard silo basing modes do not require advanced strategic or tactical warning in order to respond. Advanced warning would permit the Hard Mobile Launcher to generate more dispersal area, thus increasing survivability.

Question. The Air Force has recently reduced candidate sites for SICBM basing from 51 to 24. What is the next step in the process and when will a final basing decision be made?

Answer. In late 1986, decisions are to be made on whether the small missile is to enter full scale engineering development. At that time, basing mode(s) and deployment area selections are also to be made. Between now and then, the Air Force is conducting environmental and mission conflict analyses on each of the candidate installations. Following completion of those studies in October-November 1986, deployment area recommendations will be formulated. No determination has been made of the number of missiles or deployment locations that might be required. Force structure decisions will be dependent upon military needs, results of continuing arms control negotiations, and progress on other strategic programs.

Question. Is the Air Force considering utilizing a mix of candidate basing modes? What implications would this have on cost? What advantages might it create for survivability?

Answer. The Air Force recently completed a study which evaluated the costs of basing the Small ICBM in hard mobile launchers and hard silos. A theoretical force of 500 Small ICBMs was studied with 250 missiles deployed in Hard Mobile Launchers on government land followed by 250 Small ICBMs deployed in hard silos. Advantages to dual basing include: (1) the confusion and uncertainty imposed upon Soviet planner attempting to mitigate such a dual deployment and (2) the savings to operating costs brought about deployment in a fixed basing mode. However, such savings were quickly lost due to the additional cost of conducting two spearate research and development programs for these two basing modes. There is no indication that mixing two basing modes necessarily improved the survivability (over deployment of the system in the more survivable of the two individual modes).

MIRVING MIDGETMAN

Question. Some have advocated increasing the size of the small ICBM to accommodate multiple warheads. They argue that this would produce cost savings and/or provide additional force structure.

Others argue that such a move would delay the program and would jeopardize mobility, and hence survivability.

The Defense Science Board Task Force in its report issued last month concluded that an increase in SICBM weight should be allowed to 37,000 pounds, but concluded that an increase in size to the 70,000 pound range discussed by MIRV advocates could seriously complicate mobility. Does the analysis done by the Air Force support the DSB Task Force conclusion?

Answer. Air Force engineers believe that a hard mobile launcher to carry a 70,000 lb missile will weigh over 260,000 lbs. Such a vehicle would be up to sixteen feet wide and over 100 feet long. Some bridge limits prohibit vehicles of over 200,000 lbs and would require restructuring to accommodate larger vehicles. The Air Force will conduct a study this summer to ascertain the mobility implications of hard mobile launchers to support missiles up to 70,000 lbs. The results of this analysis, which should include on- and off-road capabilities, should be available later this fall.

Question. The Task Force conclusion indictated that, given existing Soviet accuracies, M-X in some form of deceptive basing was more cost effective than Midgetman. But as Soviet accuracies improved to 300 feet CEP or beyond, or as they went to MARV or earth penetrators, then the SICBM becomes more cost effective. Do you agree with this assessment?

Answer. Survivability of the Small ICBM in dispersed Hard Mobile Launchers is not affected by the improvements in Soviet accuracies, as are fixed basing modes. Thus, as accuracies of Soviet systems improve, cost effectiveness per surviving warhead of fixed based basing mode systems decrease, while the surviving RV's for hard mobile launchers remain unchanged. The most optimum approach for deployment is a mix of ICBM's, deployed in silos and mobile platforms, which synergistically tax the ability of the Soviet planner to negate both systems. The level of accuracy needed to threaten superhard fixed targets is very difficult to achieve and it is unlikely the Soviets can achieve it in any reasonable time span or have confidience in an attack dependent on it.

WARHEAD SIZE FOR SICBM

Question: One reason given by the DSB Task Force for increasing the weight limit to 37,000 pounds was to preserve the option of putting two warheads of smaller size than the MK 21 on the Midgetman. Has the Air Force examined this issue? Are there existing warheads that might be used or would a new development be required? What implications would such a move have for target coverage, could it be combined with MARV to produce the same hard target kill capability?

Answer: The Air Force has done no detailed analysis concerning placement of two warheads on the Small ICBM but is planning to begin an analysis in the near future at the direction of OSD. Placement of two warheads of less than the MK 21 would require (1) new development of a warheard in order to maintain its present operational capabilities for a prompt, countermilitary capable system, (2) a change in the operational requirements for the Small ICBM. Implication on target coverage would be predicated on the characteristics of the selected warhead and overall system design and deployment. There is a possibility of combining a new warhead with a MARV capability, but the 37,000 lb missile could only carry on MARV/RV, due to the weight of such a payload configuration. Additionally, such configurations could well provide significant range penalties when the payload weights of such future designs becomes more defined.

MOBILE LAUNCHERS

Question: Beyond the question of whether we could build a mobile launcher to accommodate a 70,000 pound missile, there is the issue of improvements that would be needed in road and bridge structure. Has the Air Force examined this issue? What would be the implications for off road mobility, and how important is this for survivability?

Answer: As a portion of the full scale development (FSD) decision process, the Air Force will conduct an analysis of a hard mobile launcher to accommodate a 70,000 lb class missile. This analysis will be conducted this summer and the results should be available to support an FSD decision later this fall. Initial indications are that a hard mobile launcher to support a 70,000 lb class missile could weigh over 260,000 lbs and would require improvements in bridge and road structure to insure on-road mobility. The analysis should provide details on impacts of off-road mobility for vehicles of this size and weight.

AIR DEFENSE INITIATIVE

Question: I understand that the FY 1987 budget request includes $50 million for initiation of an Air Defense Initiative. It appears that this effort is designed to complement SDI efforts in determining if an effective defense can be developed to the full range of the nuclear threat. What will the funds requested on the budget be used for?

Answer: The Air Defense Initiative (ADI) request funds four program elements (PEs). Two existing sensor development PEs will continue development of survivable sensor concepts for detecting cruise missiles and other low observable air vehicles. These PEs are 63424F, Cruise Missile Surveillance Technology, for space-based concepts and 63716F, Atmospheric Surveillance Technology, for ground-based and airborne concepts. These PEs will begin developing hardware for demonstrating and field testing sensor concepts in 1987 and will begin exploring concepts for non-cooperative discrimination of hostile vehicles. These PEs constitute approximately $48 million of the requested funds for ADI. These sensor developments are needed for the tactical warning and attack assessment mission as well as in support of ADI.

Two new PES created for ADI are 63368F, Air Defense Battle Management Technology and ——— Technology. These PEs will evaluate alternative air defense system architectures, study distributed command and control architectures with integrated decision aids/artificial intelligence tools for air defense, develop preliminary designs for ——— and conduct trade studies for selection of a baseline intercept vehicle in FY 1987. These PEs constitute approximately $5 million of the requested funds for ADI.

FIVE YEAR PLAN FOR AIR DEFENSE INITIATIVE

Question. What is included in the five year plan for this initiative?

Answer. The five year plan proposes advanced development of technologies for the surveillance, battle management and weapons systems needed for an air defense system. The emerging technologies will be incorporated into system concepts for architectural studies. Promising system concepts will be developed into demonstration systems for testing in the operational enviornment. Surveillance sensor development began in FY 1985 and thus leads the battle management and weapons areas. Since these sensors are required for the tactical warning/attack assessment mission independent of future decisions on deployment of an air defense system, several candidates have already been identified for demonstration beginning in FY 1988. Successful sensors will begin full scale engineering development in FY 1990. Battle management and weapons systems will be demonstrated beginning in FY 1991.

Question. Under Secretary of Defense for Policy Ikle has initiated a study called Strategic Defense Architecture 2000, what is the relationship between this study and ADI?

Answer. The ADI effort will build on the results of the Strategic Defense Architecture 2000 (SDA-2000) study. The operational requirements and system architecture developed by SDA-2000 will be the starting point for ADI operational concept development, technology roadmaps, and system trades.

Question. Does Air Force have any preliminary ideas as to what may be required in the air defense area, when they would be available, and what they might cost?

Answer. The Air Force has determined a number of technologies that must be advanced in order to develop an air defense system. These include new missile seekers and propulsion systems, decision aids/artificial intelligence tools for the battle commanders, command and control techniques and survivable surveillance sensors capable of long range target detection and identification. System concepts and architecture studies to be conducted in FY 1987 will enable estimates of cost and schedule for the deployment of an air defense system. At this time it appears that systems could be deployed on a similar schedule as Strategic Defense Initiative (SDI) systems for ballistic missile defense.

Question. How is the competition of an air defense fighter between the F-16 and F20 being coordinated with this effort?

Answer. The Air Defense Competition aircraft will be fielded to meet the mid 1990s and beyond threat. The intent is to have the aircraft work within the existing air defense environment. Inherent in the Air Force solicitation is a requirement for adequate growth potential to accommodate future developments within the air defense structure.

Mr. DICKS. Mr. Murtha also has a few questions to be answered for the record.

SOFTWARE ENGINEERING INSTITUTE (SEI)

[CLERK'S NOTE.—Questions submitted by Mr. Murtha and the answers thereto follow:]

Question. The Software Engineering Institute (SEI) was established by the Department of Defense (DoD) as a new national laboratory in January, 1985. Its primary mission is to identify, refine and implement technology solutions to help counteract a growing software crisis of multiple dimensions: a. increased foreign competition, b. growing mission critical system maintenance and improvement backlogs, and, in particular, c. the rapidly increasing shortage of software professionals required to develop new defense software (estimated to be one million person shortfall by 1990).

The SEI has achieved or exceeded all planned goals for the first year of its initial five-year $103.0 million (estimated cost) start-up phase. Regarding the above information, why has the USAF reduced the FY 87 funding level of $14.7 million by $5.0 million?

Answer. When the USAF reduced the planned FY 87 budget, all available data indicated that there were program start-up delays. We have been closely monitoring the progress of the SEI program and believe they are now back on the original schedule. Based on this information we plan to adjust the budget profile to reflect the current program status.

Question. Please furnish me a status report on the USAF's need for the functions of the SEI, and the accomplishments to date of the SEI.

Answer. The USAF has a tremendous need for supporting and developing new mission critical software. The use of digital computers in USAF weapon systems is pervasive. The SEI could support our efforts to transition software from the laboratory into weapon systems. SEI could also support software engineering needs, do advanced research, and help develop software educational tools.

The SEI has published several reports on software technology and environments. Examples include reports such as "User Interface Technology", "Database Support for Software Engineering Environments" and "Distributed Systems Technology". The SEI has developed a standardized methodology for the evaluation of Ada development environments. In summary, SEI has made progress and we expect SEI to be an integral part of the USAF (and other Defense Department agencies) software development and support program in the future.

Question. The USAF and OSD supported reduction of $12.0 million over three years would severely disrupt the progress of this much needed program. What is the reasoning behind this type of action?

Answer. When the USAF was preparing the FY 1987 President's Budget request, the SEI contract had just become effective. The data available at that time indicated that, because of program start-up delays, the budget profile should be adjusted. It now appears that SEI is on the planned schedule. The Air Force plans to adjust the budget profile to reflect the current program status.

[CLERK'S NOTE.—End of questions submitted by Mr. Murtha.]

Mr. DICKS. Gentleman, thank you very much. We have another hearing on Research, Development, Test, and Evaluation, Defense Agenices to follow. It would be appreciated if you would answer the committee questions for the record.

[CLERK'S NOTE.—Questions submitted for the record and the answers thereto follow:]

T-46 TRAINER

Question. The Air Force is requesting $10.8 million under the T-46 Trainer Aircraft. It appears the most, if not all, of these funds are for testing the F109 engine. The Air Force says that completion by 1989 of F109 development and testing "will provide a mature engine for future military use."

The Air Force is attempting to cancel the T-46 Without a T-46A, what is the need for a F109 engine? What is the "future military use" which the Air Froce refers to? What specifically are the applications?

Answer. By finishing the development of the F109 engine, the Air Force will have it fully tested and ready when we can fund production of the T-46. In addition to its planned use in the T-46 production run, other applications may also prove cost effective.

Question. The Air Force says that it cannot afford to buy the T-46A. It is obvious that the ability to train pilots must continue to be provided, and that existing T-37 trainers are inadequate for future needs. What funding is included in the FY 1987 request for those efforts? Specifically, what funds are there to improve the T-37?

Answer. Due to fiscal constraints, the Air Force has had to defer production of the T-46. FY 1987 funding is limited to continued development of the F109 engine. By continuing this R&D, the Air Force will preserve its option for future procurement of the T-46 with the F109. The Air Force plans to pursue only the essential Service Life Extension Program (SLEP) efforts on the T-37 fleet until the T-46A can be purchased. No funding is planned to improve the T-37 at this time.

Question. What does the Air Force estimate to be the cost of an alternative to the T-46A for meeting its training needs?

Answer. The Air Force will seek to extend the lifetime of the current T-37B until it can afford to procure a new trainer aircraft. The total Service Life Extension Program (SLEP) for the T-37 has been initially estimated at about $200 million to modify the entire 644 aircraft fleet.

Question. The usual Air Force response when a program cancellation is threatened is to point to sunk costs. We are told that cancelling a program will result in wasting those funds already spent. What are the sunk costs of the T-46A program?

Answer. As of mid-March, $371M has been obligated for the T-46 program. We do not consider these funds wasted, as we plan to continue the currently funded program to prove the design. The developmental money will produce a reprocurement data package, and the Lot I will validate the design's producibility. As a result, we should need only production funds when we competitively reprocure the T-46.

F-4 UPGRADE

Question. Last year, the Congress provided $15 million for developing upgrades to F-4 avionics. Why has no Descriptive Summary for this program been provided with the FY 87 documentation? When will one be provided? What does the Air Force intend to do with these funds, specifically?

Answer. No Descriptive Summary for this program was provided with the FY 87 documentation because the F-4 Modernization Demonstration was restructured by Congress, which appropriated

$15 million for F-4 avionics upgrades only, and excluded funds for a demonstration of new engines and a conformal fuel tank, which were integral parts of the original F-4 Modernization Demonstration. USAF was directed instead to conduct a cost effectiveness study on reengining the F-4, and report the results to Congress. Because we were in source selection for the modernization, all contractual initiatives were put on hold pending the results of the reengining study. At that time we will evaluate the desirability of continuing with the F-4 Modernization Demonstration. In making this judgment, we will also consider the total F-4 modification effort already funded in the FY 87 President's Budget, which includes a comprehensive avionics upgrade program. Among the improvements already in the budget for the F-4 are a new Navigation/Weapons Delivery System (NWDS), Head Up Display (HUD), AIM-9L integration, IFF improvements, voice warning system, Combined Altitude Radar Altimeter (CARA), and secure radios. Options to address other F-4 deficiencies are being explored through systems demonstrations. The extensive ongoing F-4 modification program may make a modernization demonstration unnecessary.

Question. Provide a milestone schedule.

Answer. The F-4 Modernization Demonstration was originally a $30 million program to do an avionics trade study as well as a demonstration with new engines and a conformal fuel tank. The $15 million Congressional appropriations for an avionics upgrade only was a significant alteration to the program which we may be unable to accomplish within the scope of the Request For Proposal (RFP). All contractual initiatives related to the F-4 Modernization Demonstration were stopped pending the results of the reengining cost effectiveness study directed by Congress. Until a final decision is made on the Modernization Demonstration, no milestone schedule will be available.

Question. Why has no funding been requested for FY 1987?

Answer. There is funding requested in the FY 1987 President's Budget to do extensive F-4 avionics modifications, including a Navigation/Weapons Delivery System (NWDS), Head Up Display (HUD), AIM-9L integration, Combined Altitude Radar Altimeter (CARA), secure radios, IFF improvements and others. No FY 1987 funding was requested for the F-4 Modernization Demonstration because this effort was significantly rescoped by the $15 million Congressional appropriation for F-4 avionics upgrades only, with a reengining study. The future of this program will be decided based on the results of the reengining study and consideration of the comprehensive avionics upgrade effort currently funded in the President's Budget.

Question. The Congress, in addition, directed the Air Force to study and report on the effectiveness of reengining the F-4. What action has been taken on that directive? When will a report be submitted?

Answer. An F-4 reengining cost effectiveness study has been completed and the results are now being briefed in the Air Staff and OSD. The report results will be provided to Congress in the near future.

C-17 DEVELOPMENT

Question. The Air Force is requesting $612.2 million to continue full scale development of the C-17. What is the current status of C-17 development? Are there any major deviations from the original program plan? Describe the work to be done in FY 1987.

Answer. The C-17 program completed three major milestones during 1985. First, the Defense Systems Acquisition Review Council approved initiation of C-17 full scale development in February 1985. Second, the C-17 preliminary design review process was completed in October 1985. This is the first of many reviews to finalize the C-17 total point system design. Lastly, restructure of the C-17 contract to reflect initiation of full scale development was completed on 31 Dec. 85.

The C-17 development program is on schedule to begin critical design reviews followed by fabrication and assembly of the three RDT&E test articles (flight, static, and durability) in FY 1987. The level of development effort is steadily increasing in all areas of the program, including the aircraft design and support areas. A production readiness review will be conducted by the Air Force in May 1986 to assess the contractor's ability to begin production and assembly of the test articles in FY 1987 and production aircraft in FY 1988.

There have been no major deviations from the original C-17 program plan first submitted in the FY 1985 President's Budget (Jan. 84). The only changes to the original January 1984 plan have been a slight reduction to FY 1990 and FY 1991 procurement quantity (FY 90 from 10 to 6 aircraft and FY 91 from 20 to 10 aircraft) and an RDT&E schedule slip caused from the FY 1986 Congressional and Gramm-Rudman reductions. Cost increases from these actions have been more than offset by lower inflation projections (total program cost in the 31 Dec. 85 SAR is $5.6 billion less than reported in the 31 Dec 83 SAR for 210 aircraft plus RDT&E and MILCON) and the initial operational capability is still FY 1992 (slipped from second to fourth quarter).

The work planned for FY 1987 is as follows: structural development testing, logistics support analyses, and design-to-life cycle cost analyses will continue. Operational flight program software preliminary design review will be completed. Development of peculiar support equipment, aircrew training systems, and technical data will begin. Airframe and air vehicle critical design reviews will be conducted. Fabrication and assembly of the three test articles (flight, static, and durability) will begin. Long lead activity for start-up/tooling requirements and aircraft components will also begin.

Question. Why was the simulator project removed from the C-17 program line in the FY 1987 budget? Is this an attempt to minimize the advertised cost of the program?

Answer. During preparation of the FY 1985 budget, flight simulator development funding was consolidated within PE 64227F. The FY 1985 President's Budget submitted to Congress in January 1984 reflected this action. Development funding for both new and existing simulators was consolidated in a single program element to provide the Air Force, OSD and Congress increased visibility and control of these important programs. C-17 simulator development funding was not required prior to FY 1987. The transfer of funds from PE 64231F (C-17 Program) to PE 64227F (Flight Simulator Development) is consistent with established policy and was accomplished at the first opportunity once simulator development requirements were identified. Procurement funding for the C-17 program line which is also consistent with established policy.

This was not an attempt to minimize the advertised cost of the C-17 program. The FY 1987 RDT&E Descriptive Summary forwarded with the President's Budget specifically stated the funds had been transferred (paragraph 3, Comparison with the FY 1986 Descriptive Summary and paragraph 5, Related Activities). The FY 1987 RDT&E Descriptive Summary for PE 64227, Project 3282 is titled C-17 Aircrew Training System. The C-17 Selected Acquisition Report (as of 31 Dec. 85) recently submitted to Congress includes both the RDT&E funds for C-17 and simulator development.

Question. Suggestions are being heard that it would be more cost effective to build more C-5B's than to continue with the C-17. What is the Air Force position on those suggestions? Would more C-5B's be a better approach than the C-17?

Answer. The Air Force, as well as DOD, supports the need for C-17 as reflected in the FY 1987 President's Budget submission and testimony before Congress this year. The only savings which could be realized through procurement of additional C-5B's is in acquisition costs. The Air Force's own analysis reflects these savings. However, when operations and support (O&S) costs over the life cycle (30 years) of the aircraft are considered, the C-17 is more cost effective. The Airlift Master Plan analysis compared the life cycle cost (acquisition and O&S) of procuring C-17 or C-5s and C-130s to meet long term intertheater capability and modernization requirements. The C-130s are needed with the C-5s to offset the loss of retiring older models of the C-130. No additional C-130s are required with the C-17 option since the C-17's tactical capability offsets that lost to the C-130 retirements. It showed the C-17 alternative was $16 billion (FY 82 constant dollars) cheaper and would require almost 15,000 fewer personnel than the C-5 alternative.

The C-5B would not be a better approach than the C-17. While our analysis of life cycle cost shows the C-17 to be more cost effective, a more important fact is that any alternative, including additional C-5Bs, does not provide the same capability. C-17 is the only option which increases both intertheater and intratheater capability while minimizing operating costs. It will provide our first capability to routinely airland and airdrop or extract outsize cargo/equipment in the forward areas currently restricted to the non-outsized capable C-130. C-17 will be more reliable and maintainable, more survivable, more flexible (can be used in either strategic or tactical role plus direct delivery of cargo and personnel from CONUS to the forward area), and better able to meet airlift requirements today and in the future.

Question. Given the financial difficulties we face, is curtailing or cancelling the C-17 an option? What priority does the Air Force assign to the C-17?

Answer. Procurement of the C-17 is the keystone to meeting Congressionally acknowledged airlift goals and the providing essential mobility support for the warfighting CINCs. Cancelling the C-17 is not a prudent option; that would only prolong an already significant airlift shortfall. Without the C-17, airlift force enhancement and modernization plans would be unachievable. Continued dependence on aging C-141 and C-130 forces, lack of intratheater outsize capability, and lack of direct delivery would continue to hamper efficient and capable airlift operations.

In response to the CINCs' requirements, the Air Force has made airlift a very high priority and has made the C-17 its centerpiece for airlift enhancement and modernization efforts.

JOINT ADVANCED FIGHTER ENGINE

Question. The Air Force is requesting $294.1 million to continue development of the Advanced Tactical Fighter. Of that total, $154 million are for the Joint Advanced Tactical Fighter Engine, which is planned to be the propulsion system for the ATF. In our R&D hearing last year, it was pointed out that there is nothing joint about the "Joint" AFE, and that it is strictly an Air Force project. Is that still the case? What contact has there been with the Navy in the past year to reassess the possibility of making JAFE joint in more than name?

Answer. The Joint Advanced Fighter Engine (JAFE) was originally conceived as a joint Navy/USAF program to develop an engine for each Service's advanced aircraft. However, the Navy withdrew funding in 1983 because of a change in their requirements. They presently do not contribute funds to JAFE but monitor the development program for possible future use. The JAFE is strictly a demonstrator engine. A full scale develoment version of the JAFE will be the engine eventually incorporated in the ATF. The name of the engine will change to Advanced Tactical Fighter Engine in the next change to the Program Management Directive issued by HQ USAF.

Question. Specifically, what work is planned to be accomplished in FY 1987 with the requested $294.1 million?

Answer. The Advanced Tactical Fighter (ATF) program is managed under three major projects: Project 2472 (Advanced Tactical Fighter), Project 2878 (Joint Advanced Fighter Engine), and Project 2995 (Critical Subsystems Development).

The ATF project will develop the flight vehicle and associated subsystems. FY 1987 funding for this project is $94.1 million. In late FY 1986 three or four contractors/teams will be selected to demonstrate/validate their ATF concepts through detailed design analysis and testing, mission effectiveness analysis, and wind tunnel testing. The Demonstration/Validation efforts will lead to Systems Requirements Review in mid-FY 1987. This review will present the initial contractor proposed recommendations for a Government developed System Specification. Through the remainder of FY 1987, efforts will be concentrated on preliminary design and validation of major sub-elements of the ATF system. The Demonstration/Validation phase will continue through FY 1987 with heavy emphasis on hardware risk reduction efforts in key ATF technologies. Extensive use of wind tunnel and radar cross section models will reduce risk on external airframe configuration. Full scale mock-ups will support demonstration and validation of aircraft reliability and maintainability features.

The Joint Advanced Fighter Engine (JAFE) project, an on-going 56-month program to design, fabricate and test competitive demonstrator engines, is funded at $154.0 million in FY 1987. This will continue the durability and performance demonstration of the competitive JAFE engines. Accelerated mission testing during this period will verify the capability of the candidate engines to meet ATF durability goals. The plan is to achieve over 1300 hours of engine run time for each contractor design prior to the FSD decision.

Critical Subsystems Development is funded at a level of $46.0 million in FY 1987. This will continue design and fabrication of demonstration brassboard and ground based laboratory hardware for insertion of Very High Speed Integrated Circuits (VHSIC) and Integrated Avionics Architecture. Design work will continue on ATF radar and electro-optical sensor suite as well as internal carriage of existing weapons.

Question. Requirements Review was scheduled by OSD for the third quarter of FY 1986. When will that review take place? Will the Air Force be asked at that time to defend the affordability of the ATF? What is the range of possible outcomes of this OSD review?

Answer. The Milestone I OSD Requirements Review of the Advanced Tactical Fighter, i.e., DSARC I, was scheduled for the third quarter of FY 1986. This schedule was predicated on receiving contractor responses for the Demonstration/Validation phase on December 8, 1985. However, in early November, USDR&E requested the RFP be modified to clarify the area concerning low observables. This resulted in a two month delay in receipt of proposals and the overall program schedule. DSARC I will not take place prior to the completion of source selection, currently scheduled for August 1986. Affordability is a key program issue that the Air Force will address at DSARC I. Possible outcomes of the DSARC I review range from cancellation of the program to approval to proceed with the Demonstration/Validation phase.

Question. Given our current financial difficulties, careful scrutiny is being given to all defense projects. What priority does the Air Force assign to the ATF? Why cannot ATF be deferred?

Answer. Each element of the Air Force Program, including the ATF, competes on its own merit and undergoes extensive budget review prior to becoming part of the official Air Force budget. ATF is one of the Air Force's top ten acquisition programs and is one of the top five Tactical Air Force's priorities. The ATF was supported in the FY 87 President's Budget and will represent an integral part of a planned balanced force structure from the mid-1990s and beyond. The Soviets are currently fielding significant quantities of fourth generation fighters with improved air-to-air munitions, which demands that we field aircraft to meet the threat.

Question. The Air Force and Navy are said to be examining the subject of cooperative efforts on the ATF and the Navy's ATA? Specifically, the question is whether they can both use ATF for air superiority and ATA for close air support and interdiction. Given the inability of the Services to cooperate in the past on such relatively simple aircraft as trainers, what is your estimate of success in this case? Will the Air Force really agree to the structural differences required in aircraft which are able to operate from carriers? Roughly, what savings would accrue if commonality of aircraft could be achieved?

Answer. The Navy and Air Force have both formed working groups specifically tasked by the respective Service Secretaries to examine each other's advanced aircraft and determine if they would meet unique service requirements for similar missions. They are also to determine what changes would be required to each design to accommodate the other service's requirements, the associated development costs of those changes, and the impact on each service if they were forced to use each other's aircraft without redesign. Since the final designs of both aircraft have yet to be determined, it is too early to tell whether the USAF and the Navy can use each other's aircraft. We are committed to thoroughly exploring the opportunity for cross-service utilization of our advanced aircrat. Future design trade-offs necessary to develop variants of ATF for Navy use have not yet been identified. Those trade-offs will be integrated into the final decision process for full-scale development.

Any savings arising from cross-service use of ATF/ATA would be the result of development costs associated with new weapon systems and economy of scale in production of aircraft and spare parts.

NATIONAL AEROSPACE PLANE PROGRAM (NASP)

Question. The Air Force is requesting $33.5 million as its share of funding for the National Aerospace Plane program, referred to by the President as "The Orient Express". The NASP is envisioned as a hydrogen-fueled hypersonic vehicle capable of accelerating directly into orbit. How was the size of the Air Force request determined? Did the budget originally submitted by Air Force to OSD include funds for this new program element?

Answer. The funding split is basically a function of the participants in the NASP program. Four of the five interested parties are DoD organizations.

The Air Force has been assigned overall DoD responsibility for the Aerospace Plane research program with Defense Research Projects Agency (DARPA) being the lead for the technology base.

In FY 86, ongoing hypersonic related work in already existing Air Force program elements was redirected in support of NASP program objectives. For FY 87, a new PE, 63269F, was established in the FY 87 President's Budget.

Question. The Air Force says that its portion of the NASP Technology Program alone will cost $1.02 billion. What will a full scale development program cost?

Answer. The NASP program is an experimental vehicle program. It must first be determined that the requisite technologies are in hand to proceed with the design and fabrication of an X-vehicle. This decision will be made in the FY 88–89 time frame. If the decision is made to proceed, the first flight could occur in the early 90s. The outcome of the NASP program will determine if full scale development (FSD) is feasible. Any discussion of FSD cost is premature at this time.

Question. At this point, is there any conception of how much payload a NASP could carry into orbit? In sub-orbit from New York to Tokyo?

Answer. The NASP is an expertimental vehicle and its "payload" will be a test instrumentation package. It is too early to identify payload concepts for a vehicle that is still very early in experimental development.

Question. What military applications does the Air Force envision for an NASP?

Answer. The potential vehicle has a host of uses, both military and commercial. The military utility of such a vehicle would result from its ability to respond rapidly to anyplace on the globe, its flexible basing capability, and its potential for low-cost space launch. However, the NASP program is an experimental or X-vehicle program. It is intended to bring the technologies along to a point where a decision can be made to pursue a flight demonstration program. The research vehicle will be only to prove that the technologies are sufficient to then make a decision to enter a full-scale development program. Only then will mission applications and requirements come into play.

ICBM SILO HARDENING

Question. Mr. Secretary, last year the Congress provided $15 million for an experimental effort related to ICBM silo survivability. Specifically, these funds were to be used to construct, instrument and test a structure of double-walled cofferdam design. This Committee directed that a contract for such an effort be entered not later than March 1, 1986. Has such a contract been awarded? Why not?

Answer. The Air Force is working with the Defense Nuclear Agency on both the Advanced Silo Hardening (ASH) and the External Shock Mitigation (ESM) programs. We have expanded the ongoing ESM program, which was already looking at cofferdam and cofferdam like structures, to accelerate their testing and analysis schedule. DNA has several contracts awarded already. We will continue the efforts to define critical parameters such as test article depth, spacing, radius, thickness and design. We should have enough data from our five schedule subscale tests to determine in early FY 1987 how and at what level to test a full size test article.

Question. The Committee intended, and still intends, that the structure in question be full-sized, not a scale model, and sized to be commensurate with the dimensions of a Minuteman silo. Is there any confusion on that point? What specifically are your plans for carrying out the project for which the funds were provided? On what date will a contract for construction be awarded?

Answer. There is a no confusion on the Committee's intent to conduct a full size cofferdam experiment. We believe, however, there are questions regarding blast simulator capabilities, environmental constraints and test parameters such as radius, depth, wall spacing, wall thickness, blast coupling mechanisms, cofferdam depth, etc., which must be resolved before defining the test scale and test articles. To do this, we first need to complete additional analyses and series of small scale tests. These tasks are now contract and will be conducted over the summer and early fall. We intend to have the answers, including a proposed test design and scale size by October 1986. We will then proceed into the second phase which is to conduct the large size demonstration. We will have this contract awarded as soon as possible but not later than December 1986.

Question. The appropriations conference directed that the Air Force be the planning and management agent. What is the involvement of Defense Nuclear Agency in this effort? Would you say that DNA has been helpful and responsive?

Answer. The Defense Nuclear Agency has an existing Advanced Silo Hardening (ASH) program in which we have been participating. A related effort to the ASH program is the existing External Shock Mitigation program (ESM). The ESM program was already looking at cofferdam and cofferdam like technologies for new and existing silos. We have jointly increased the size, scope and level of effort of the ESM program to define the parameters of a full scale cofferdam experiment. DNA has been most helpful and as responsive as possible, considering statutory contracting requirements.

MX PEACEKEEPER MISSILE

Question. The Air Force is requesting $352.3 million to continue MX development. The principal efforts planned for FY 1987 are six flight tests of the missile. To date, approximately $6.1 billion has been spent on MX development. The Air Force says that MX testing has been highly successful. Please discuss the explosion of a stage III motor in November 1985. Have there been any similar test failures which are causing concern? What have been the results of missile flight tests to date? What is the status of modifying Minuteman silos for MX deployment?

Answer: The Peacekeeper test program has been extremely successful to date. We have had 11 for 11 successful test flights. Accuracy is outstanding, almost twice that of Minuteman III.

The explosion of a stage III motor in November 1985 in no way diminishes the success of the test program. The explosion was caused by a random manufacturing error which went undetected by Quality Control. The manufacturing process and the quality assurance procedures have been changed to preclude reoccurrence. Two static firings and one additional firing at altitude have confirmed the new procedures. There have been no similar test failures in any other portion of the program.

The modification of Minuteman silos for Peacekeeper deployment continues on schedule. The first two silos will be modified and two missiles will be on alert by 30 September 1986. Initial Operating Capability of ten sites and missiles will be achieved by the end of December 1986.

Question. The Department's annual report to Congress on ICBM Modernization states that the MX C^3 system is still in development. When will an operational version of launch control and operating software be available? How long has the current development version of that software been in development? What specific problems have been uncovered in connection with recent test flight?

Answer. The operational software for First Missile Turnover will be available July 31, 1986. A refined version of the operational software that adds capability will be available October 31, 1986. This software development was begun in June 1983.

The only significant program occurred on Flight 11. During prelaunch Enable/Target Transfer sequence, the system entered standby NO-GO due to a software failure to turn on flight ordnance Electronics/Reentry System power. A fix to the software problem has been identified and will be incorporated.

Question. Discuss the modification of the ALCC. Why is it that only engineering model equipment has been fabricated at this late date? Do you expect the modified ALCC to be available by December 1986?

Answer. The Peacekeeper/Minuteman Common Airborne Launch Control Center (ALCC) modification is on schedule to provide the airborne launch control capability for Peacekeeper initial operational capability (IOC) of December 1986. The Common ALCC modification replaces the obsolescent Minuteman ALCC equipment with a new common equipment suite that fulfills the operational airborne command and control requirements of both Minuteman and Peacekeeper. The Common ALCC test program to date has successfully verified the new equipment function and design through rigorous tests of engineering models; all testing was completed on schedule. The next series of tests will start in June 1986 and will use the actual equipment that will provide the alertready capability for the December 1986 Peacekeeper IOC.

Question. Provide for the record a listing of specific MX C^3 projects. For each, show the start date, the original estimates of development and procurement costs, and the current estimates of development and procurement costs.

Answer:

Project	Start date	Original estimates	Current estimates
Peacekeeper Ground Launch Control System	Jan 82	Development (TY) $320M	$332.1M
		Procurement (FY) $279.1M [1]	$164.7M
Airborne Launch Control Center	Oct 83	Development (TY) $100.2M	$110.1M
		Procurement (TY) $71.3M	$71.3M

[1] The original baseline was for 100 launch facilities (LFs)and 10 launch control facilities (LCFs); the current baseline is for 50 LFs and 5 LCFs.

Question. The Air Force is requesting $389 million to continue study of alternative basing technologies for MX. Provide for the record a description of each of the technologies being funded. For each, show the funding for FY 1986, FY 1987 and FY 1988. Further break down each funding item to show how much will go to contractors engaged by the Air Force, to contractors engaged by the Defense Nuclear Agency, and to in-house activities.

Answer. In December 1986, we will select a mode(s) from the eight under consideration: hardened Minuteman, superhard silos with and without deception, carry-hard, shallow tunnel, ground and rail mobile, and deep basing. In order to have the right data to support the December decisions, the FY 86 program is structured as follows:

Concealment	$20 M
System and Subsystem Concept	9 M
Hardening Technology	6 M
Constructibility	1 M
Total	$36 M

The FY 1987 request supports vigorous, pre-full scale development on the selected mode(s) for deploying of a second 50 Peacekeepers. The FY 1987 request supports the following effort:

Deep Basing	$20 M
The selected mode(s):	
Conceptual Design and Component Testing	130 M
Facility Design and Testing	15 M
Blast and Shock Testing	60 M
Concealment Testing	65 M
Environmental Siting	25 M
System Engineering	74 M
Total	$389 M

The FY 1988 request is to be determined and will depend on which mode(s) is/are selected in December 1986. The FY 86 funding is sufficient to support the December 1986 decision through continued testing and analysis including work on concealment, hardening, constructability, launch control technology and systems and subsystems definitions. Each portion of the FY 1986 work is generally applicable to two or more basing modes. In FY 1986, $3 M is being sent to DNA. One million will be sent for hardening technology, $2 M has been sent to DNA for initial efforts to define the parameters of a double-walled cofferdam experiment. About $13 M will go to the Army Corps of Engineers Waterways Experimental Station in FY 1986 for hardening technology. The FY 1987 and FY 1988 contracts have not been awarded. The contractors and participants for FY 1987/88 basing work will be determined by the mode(s) selected.

SMALL ICBM

Question. The Air Force is requesting $1.38 billion to continue development of the Small ICBM and its Hard Mobile Launcher. How much of the requested funds are for development of the missile itself, and how much are for the launcher?

Answer. About 40% of the FY 87 request is for development of the missile and its components. About 25% of the FY 87 request is for development of the Hard Mobile Launchers. The remaining 35% if for logistics, support, system engineering, basing definition and other related basing work.

Question. Although a specific figure was not provided, the FY 1986 budget projected that approximately $900 million would be required in FY 1987 for the Small ICBM. Why is a much higher figure of $1.38 billion requested?

Answer. The FY 1986 budget did not project a specific figure for the FY 1987 Small ICBM request. The Small ICBM program requests $1.38 billion to enter Full Scale Development in early FY 1987. This is the amount required to start the process of reaching Initial Operating Capability by December 1992.

Question. What is the current status of development? Have any fundamental technical problems been uncovered?

Answer. The Small ICBM program is on track to enter Full Scale Development in early FY 87. The program continues to be an outstanding technical success with no problems to date.

Question. What is the Air Force estimate of schedule risk associated with an IOC of 1992?

Answer. The schedule risk for the Air Force baseline program (30,000 lb, single RV ICBM, in Hard Mobile Launchers on government land) to support a 1992 IOC is considered low.

Question. Recently, Dr. Hicks suggested the possibility of making the Small ICBM a 75,000 missile carrying three warheads. Does that square with the Air Force's understanding of the Scowcroft Commission findings? Has the Air Force ever examined this possibility? Has the Air Force been asked to do so?

Answer. The Air Force understands the recommendations of the Scowcroft Commission to be: immediate deployment of 100 Peacekeeper missiles in existing silos; immediate engineering design and development of a single warhead ICBM, weighing about "15 tons"; and continuation of ICBM basing technology programs. The President's Modernization program supports these requirements as do Air Force programs and FY 87 budget submission.

The Air Force has pursued a 30,000 lb missile as the baseline design for the Small ICBM program since receiving direction from the Department of Defense in August 1983. Recently, the USDR&E has requested Air Force views on consideration of alternative concepts for full scale development decision process, including a multiple warhead missile in the 70,000 lb class. If mobility can be maintained at the heavier weight, cost per deployed RV can be reduced. The Air Force is evaluating these issues in preparation for the DSARC in December.

ASAT RESTRUCTURING

Question. The Air Force is requesting $278 million to continue development and testing of the ASAT system. Last year, the Air Force said that $80.4 million would be needed for ASAT R&D in FY 1987. Air Force documentation says that the figure is more than triple to "reflect a major restructuring." What exactly has been restructured, and why? What is the liability of the contractors in this case? Are they being required to pay for their failures?

Answer. The FY 1987 President's Budget request reflects a complete restructure of the ASAT program as a result of an independent review conducted last summer and several previous recommendations made by Congress. The independent evaluation concluded that ——— should be purchased at this time to address the near-term threat. A final force structure should be determined in the early 1990s when we will consider other promising technologies, such as a ground-based laser. In addition, the independent review concluded that, although the development effort had been properly structured to verify the concept, it would not support transition to production with reasonable risk. The restructured program adds a production transition phase, to make the system more producible, supportable, and operable. Production will now start in FY 1988, with long lead procurement to be initiated in FY 1987.

The majority of the increase in the FY 1987 budget request is due to the $158 million required for the production verification effort. An additional $18 million is due to an accounting transfer of the Prototype Mission Operations Center (PMOC) activities from the Cheyenne Mountain Complex Program Element.

The specific contractual arrangements are being finalized at this time. It is our intent to incentivize the contractors to minimize cost, while meeting all schedule and performance requirements. However, due to the technical risk and many perturbations which cannot be controlled by the Air Force, the development contracts will remain Cost-Reimbursable.

Question. What specifically is to be done with the $278 million requested for FY 1987? Provide a list of tasks and their associated costs.

Answer. The $278 million of RDT&E being requested in the FY 1987 President's Budget will fund the following tasks/efforts:

Continuation of development program	$57M
Implementation of Production Verification	158M
Prototype Mission Operations Center operations & maintenance	18M
Instrumented Test Vehicle development	5M
Support (Includes range costs, program management, launch support, Independent Verification & Validation activities, General Systems Engineering—Aerospace Corp)	40M

Under the Production Verification effort we will procure additional flight test development units; incorporate several Pre-Planned Product Improvements to make the system more operable, supportable, and producible; conduct additional system testing; develop improved flight line missile and intermediate test equipment suitable for blue-suit maintenance; and accomplish logistics/supportability planning/studies.

The $57 million allocated to continue the development program will be used to build, test, and assemble the remaining test missile assemblies. Four test missile assemblies will be delivered in FY 1987.

Question. The Air Force estimates that another $226 million will be needed in FY 1988 to continue ASAT. How much has been provided through FY 1986? What are the current estimated costs for ASAT development, procurement, and military construction? Explain and differences in those figures from those w were given last year: $1.4 billion for RDT&E, $2.64 billion for procurement, and $39 million for military construction.

Answer. Funding currently provided through FY 1986 is provided below (in then-year dollars):

RDT&E	$1261.9M
Procurement	106.3M
Advance Procurement	28.3M

The current estimated cost for the restructured ASAT program is as follows (in then-year dollars):

RDT&E	$2024.7M
Procurement	1795.4M
Military Construction	15.6M

Reasons for the changes from data provided last year are:

DDT&E—Approximately $115M of the increase in development funds is due to an accounting transfer of the Prototype Mission Operation Center (PMOC) activity from the Cheyenne Mountain Complex (CMC) Program Element to consolidate the overall program. The remaining $500M was added to implement a production verification phase which resulted from an Independent Review performed last year and several previous recommendations from Congress. The production verification will incorporate changes/upgrades to make the system more operable, supportable, and producible.

Procurement—The fundig reduction is due to a significant decrease in the missile quantities being procured from ———. However, the cost per missile has increased from ——— due to a less-than-optimum production profile and inflation adjustments. In addition, the number of sets of Carrier Aircraft Equipment (CAE) has been significant decreased from ———. Again, the cost per unit has increased due to a less-than-optimum production profile and inflation adjustments.

Military Construction—The reduction in military construction funding is due to a reduction in operational bases from two to one. The facility at McChord AFB, WA, has been deleted leaving Langley AFB, VA, as the single operational base.

Question. Identify all places in the FY 1987 budget, together with dollar amounts, where funds are requested related to planning, acquisition and use of an ASAT operational facility at Langley AFB.

Answer. The FY 1987 funding associated with the ASAT operational facility at Langley AFB is:

Program Elem	Approp	Amount	Effort
64406F	RDT&E	$0.8M	Activation Planning/Studies
12450F	MILCON	15.6M	Facility Construction
12450f	Other Proc.	2.0M	Base Security System

SHORT RANGE ATTACK MISSILE

Question. The Air Force is requesting $164.7 million to begin fullscale development of the Short Range Attack Missile II (SRAM II). This new nuclear weapon is to replace the existing SRAM now available for carriage by penetrating bombers. Last year, the Air Force stated it would be able to make an accurate estimate of total development costs following completion of 10-month study contracts awarded in February 1985. Have those studies been completed? What does the Air Force estimate to be the total cost of developing SRAM II?

Answer. SRAM II has successfully completed the competitive system definition studies. These studies helped us determine our preferred missile configuration and refine our cost estimates.

The cost of the SRAM II program has received top-level management attention. With the goal of reducing program cost, the Air Force has reviewed the requirements for SRAM II, the difficulties experienced in developing the existing SRAM-A motor, the unsuccessful attempt to extend its life, and the cost effectiveness analyses accomplished during the system definition studies. As a result of these reviews, the SRAM II program is being restructured. The costs of the revised program are still being reviewed and, once approved, will be submitted to Congress.

Question. How can full scale development begin when only system definition studies have taken place? When was advanced development accomplished?

Answer. The SRAM II program is currently in advanced development. The system definition studies were the first phase in this development category. These studies were substituted for the more traditional concept exploration and validation efforts. In the studies the competing missile system contractors performed subsystem trade studies, risk abatement studies and preliminary system design. The studies reduced risk and continued the focus on high risk areas so that intelligent decisions could be made in creating the SRAM II system specification.

Question. The Air Force says that increased Soviet defenses against penetrating bombers are a driving reason for SRAM II. Does that indicate concern over survivability of the B-1B? Does it indicate concern over survivability of the ATB? Why isn't an adequate capability provided by the ATB armed with existing SRAM's?

Answer. The SRAM II program was established to provide a safe and reliable replacement for the current SRAM-A. The program exists in its current form because of several events that have occurred over the history of the current SRAM: (i) difficulties in developing its motor; (ii) motor anomalies during operational testing indicative of age-related problems; (iii) unsuccessful attempts to correct these problems and extend its life; and (iv) warhead safety issues. As a result, modification of the SRAM-A was not deemed cost effective. A replacement short-range stand off weapon was the best solution using today's technology as a base.

Technology has progressed since the SRAM-A was designed in the late 1960s. At the same time, the Soviet threat has grown more robust, and projections of its capability into the next century show further improvements in depth and capability. When faced with the design of a replacement, the cost of a missile with precisely the same performance capability of the current missile will be nearly that of one with increased performance. Thus, it is only prudent to include improvements in range, accuracy and yield, within the limits of acceptable cost and schedule, in the replacement missile to help insure its effectivenss well into the next century. One must keep in mind that the SRAM-A has had a long life; we can expect the same to be the case for its replacement.

Improvements in capability, therefore, represent a sound business/military decision. They do not reflect any concern over the capability of either the B-1B or the ATB in their roles as penetrating bombers in the 1990s and beyond. The improvements, therefore, will result in a highly-effective missile capable of operating well into the twenty-first century.

Question. Given our present financial difficulties, some programs desired by the services will probably have to be curtailed or cancelled. What priority does the Air Force assign to SRAM II?

Answer. Each element of the Air Force Program, including the SRAM II, competes on its own merit and undergoes extensive programmatic and budget review prior to becoming a part of the official Air Force budget. By virtue of being submitted in the FY 87 President's Budget, the Air Force assigns a very high priority to SRAM II, as well as other weapons systems, in an effort to develop a balanced force structure.

MINUTEMAN SQUADRONS

Question. The Air Force is requesting $67.5 million for R&D activities related to Minuteman Squadrons. Included in that request are $27.2 million for a new start on a program to replace Minuteman integrated electronics equipment. Specifically, what equipment is planned to be replaced? Why must it be replaced? What specifically are the current problems which cannot be overcome except by replacement?

Answer. The integrated electronics replacement program replaces the launch control system and associated interface equipment used to command and control missiles from all 100 Minuteman launch control facilities. The program also provides for requalification of semiconductor piece parts launch control facilities and launch facilities throughout the force. The present equipment is becoming nonsupportable due to age and obsolete technology originally used to build the system. Substitute parts are presently being procured, but sources are becoming harder to find as vendors are rapidly phasing out of this old technology. To correct these supportability problems, some equipment must be replaced while other equipment can be fixed by redesigning the semiconductor piece parts.

Question. This program was not projected in last year's submission as requiring FY 1987 funds. What has occurred which now makes FY 1987 a requirement? What is the total estimated cost of developing this replacement equipment? Of procuring and installing it?

Answer. This program was projected in FY 1986 as requiring FY 1987 funds, however the funds were included in the Missile Procurement Replacement Equipment and Replenishment Spares accounts, not in R&D as requested this year. Last year's program involved isolated, piece-by-piece replacement of electronics drawers. This year's request reflects a revised, integrated approach that looks at all components that need replacing, and then uses R&D funds to optimize the replacement design to save money and improve system performance by combining common functions. Overall, no additional funds are required for this integrated approach—funds have just been realigned between appropriations accounts in the FY 1987 request. Total estimated development cost is $58 million. Total estimated procurement cost is $391 million. Total estimated installation cost is $15 million.

AIRFIELD ATTACK

Question. The Air Force has been developing the Boosted Kinetic Energy Penetrator (BKEP) as a submunition for airfield attack. A series of flight tests began in May 1985, with resportedly very poor results. Tests were suspended by the Air Force in early 1986. Briefly, what has been the problem with BKEP testing? Provide for the record a complete description of each test done since May 1985, showing objectives, actual results, and analysis of failure. Do these failures indicate that more development work is needed on BKEP?

Answer. The BKEP failures can be traced to the Medium Range Air-to-Surface Missile (MRASM) test dispenser and the tantalum capacitor power supply used in the MRASM version of the BKEP. BKEP was originally planned to be dispensed from MRASM. The MRASM flight profile and delivery concept required a capability to power-up and power-down the BKEP fuze as the MRASM cruised to multiple dispense points. A tantalum capacitor was chosen to provide this capability. It has proven to be unacceptable due to its sensitivity to accelaration, losing its charge when it is jarred or bumped.

The MRASM dispenser was replaced with a modified SUU-20 dispenser once it was discovered the MRASM dispenser imparted too high an acceleration when the BKEPs were dispensed causing the tantalum capacitor to lose its charge. Once the tantalum capacitor loses its charge there is no electrical power available to the fuze resulting in a subsequent failure. While the new dispenser did solve the dispenser acceleration problem, the tantalum capacitor continued to cause failures. The tests since May 1985 are summarized in the attached.

No additional development of BKEP is anticipated once the ongoing fuze modification program is complete this fall. The program was initiated by the Air Force in late 1984 to replace the capacitor power supply with a more reliable thermal battery. After evaluating contractor proposals the contract was changed in July 1985 to replace the tantalum capacitor with a thermal battery. The thermal battery is considered low risk since it is similar to the battery used in the Skeet warhead which has not had any problems. The modified fuze will complete testing this fall in time to meet the Direct Airfield Attack Combined Munition (DAACM) development schedule.

SUMMARY OF BKEP FLIGHT TESTS—MAY 1985 TO JANUARY 1986

Date	Objective	Success	Failure	Comment
18 May 85....	Test dispensing and chute operation.	2	....	Two dummy BKEPS successfully demonstrated dispensing and chute operation.
23 May 85....	Test dispensing and rocket motor.	1	3	One failed due to improper initiation by the dispenser. Two failed due to capacitor losing its charge.
23 May — 14 Aug 85: Testing was suspended awaiting a new test dispenser.				
14 Aug 85....	Test dispensing..........................	2	....	Two dummy BKEP mockups successfully demostrated dispensing from the SUU–20.
21 Aug 85....	Dispensing and chute operation.	4	....	Two dummy BKEPs demonstrated dispensing from a second SUU–20. Two BKEPs with chutes successfully demonstrated dispensing and chute operation.
23 Aug 85....	Live BKEP test..........................	1	3	One successfully demonstrated live BKEP operation. One failure caused by fuze voltage regulator failure. Second failed due to capacitor losing its charge. Third failure due to a too shallow impact angle, BKEP did not survive impact.

SUMMARY OF BKEP FLIGHT TESTS—MAY 1985 TO JANUARY 1986—Continued

Date	Objective	Success	Failure	Comment
23 Aug 85 — 18 Dec 85: Testing suspended to review hardware configuaration and to reevalute the SUU–20 modified dispenser.				
18 Dec 86	Dispensing and chute operation.	2		BKEP mockup demonstrated dispensing. Second BKEP with chute successfully demonstrated chute operation.
13 Jan 86	Chute operation	1		Two BKEPs with chutes were flown but only one dropped since needed data was gathered on first drop.
20 Jan 86	Live BKEP test	1	[1] 1	Both BKEPs missed small target runway due to release errors. One hit in a hard area and functioned properly. Second hit in soft sand, deceleration forces were not large enough to cause the fuze to function.
24 Jan 86	Live BKEP test	1	1	One functioned successfully. Second did not detonate, capacitor is suspected.
28 Jan 86	Live BKEP test		1	Rocket motor did not ignite, capacitor suspected. A second BKEP was not dropped because capacitor did not charge properly.

[1] No test.

Question. No FY 1987 R&D funds are requested for BKEP development, while funds are requested to integrate BKEP into dispensers. However, BKEP obviously needs more work. How can you continue development with no money? In particular, where is work to redesign the BKEP fuze being funded?

Answer. The modification to the BKEP fuze is to replace the tantalum capacitors used as an electrical power source with a more reliable thermal battery. In late 1984 the Air Force started work to incorporate a thermal battery in the BKEP fuze. The contract was changed in July 1985 to modify the BKEP fuze using FY 1985 and FY 1986 funds within PE 64604F. Testing of the modified BKEP fuze is planned this fall in time to meet the Direct Airfield Attack Combined Munition (DAACM) development schedule.

Question. How long has the Air Force been attempting to develop runway busters? Don't these efforts date back to the 1960's? How much has been spent on these submunitions? Specifically on BKEP?

Answer. The Air Force established a requirement to develop runway cratering weapons in the late 1960's. In the mid 1970's the Air Force conducted a low-cost laboratory effort, Clustered Air Defeat Munition (CADM), to demonstrate feasibility of the concept of a submunition-based airfield attack weapon. Then, from the late 1970's until cancelled by Congress in 1981, we were in joint development of the JP–233 with the United Kingdom. This termination occurred during the development of the Medium Range Air-to-Surface Missile (MRASM).

The CADM effort laid the groundwork for the BKEP, which was ultimately selected for the MRASM payload. BKEP is the first and only submunition that has entered full scale development. Because BKEP was promising for use in other weapons, its development was continued as a separate effort after MRASM was cancelled in August 1983. BKEP development ($35.9 million total) is being completed with FY 1986 funding. This includes modifications which were contracted for in July 1985 to change the BKEP from a

MRASM configuration to a simpler, more reliable and cost effective configuration for the Direct Airfield Attack Combined Munition (DAACM) and any other future weapons.

We are now reaping the benefit of this investment by having a submunition completing its development as the DAACM integration effort begins. This two-phased approach has significantly reduced the risk of the DAACM program, and will culminate in fielding a weapon three times as effective as Durandal.

Question. What runway attack submunitions are there which are already operational? What testing has the Air Force made of those operational submunitions?

Answer. There are currently no runway attack submunitions operational. The Boosted Kinetic Energy Penetrator (BKEP) submunition to be used with the Direct Airfield Attack Combined Munition (DAACM) is still in the test phase to determine final design prior to production. Thus far, tests accomplished with the BKEP have included sled firings, live tower launches, and rocket motor firings. A successful air drop of a live round was also demonstrated in Aug 85, and the air drops are planned to resume in Sep 86 after some minor design changes. First deliveries of DAACM are planned for ———.

Questions. What consideration has the Air Force given to cancelling BKEP development and simply using an already operational submunition?

Answer. The Air Force has not considered cancelling the BKEP. The BKEP currently represents the most mature submunition for use in the Direct Airfield Attack Combined Munition (DAACM). The Air Force is continuing to monitor other airfield attack submunitions that could potentially be used in DAACM. The German Stabo if modified could be used in DAACM although its cratering performance is inherently limited by the Stabo warhead which is half the size of the BKEP warhead. Stabo is more mature for employment in the German MW-1 airfield attack system for which Stabo was designed, but is less mature for DAACM employment. The Stabo contractor has estimated 2 to 3 years of development would be needed to make Stabo compatible with DAACM.

Questions. Last year, the Air Force planned to put BKEP into the AGM-130B, a carrier which has since been cancelled. The remaining carrier is the Tactical Munitions Dispenser, which is to be loaded with BKEPs and harrassment mines, thus forming what is called the Direct Airfield Attack Combined Munition (DAACM). How much funding is requested specifically for DAACM within project 2586 in FY 1987? How much is anticipated for FY 1988? Provide a breakdown of those funds, showing separately how much is for TMD, BKEP development, BKEP integration, etc.

Answer. FY 1987/1988 funding is $17.7 million and $10.8 million, respectively. All of these funds are for DAACM integration of the BKEP and British HB-876 airfield denial mine rather than TMD and submunition devlopment. The TMD and its proximity fuze were developed previously, and are off-the-shelf components which are also used in Gator, Combined Effects Munition, and Sensor Fuzed Weapon. The BKEP development has been funded under PE 64604F, Submunitions Development, which completes development with FY 1986 funding, although there is potential for minor BKEP product improvements under the DAACM program. The HB-876 mine was developed under the British JP-233 program, and is currently in production. The integration effort includes the airbag dispensing system and the control unit which sequences the submunitions, both of which are demonstrated technologies.

Questions. Describe the development and test program for DAACM. Include a milestone chart.

Answer. The DAACM development and test program is unusual in that it is simply an integration effort of components of which the majority are either in production, such as the Tactical Munitions Dispenser (TMD), the proximity fuze, and the British HB-876 mine, or are completing development, such as the BKEP. The only additional components are the airbag dispensing system and the control unit which sequences the submunitions, both of which are demonstrated technologies.

Additionally, a significant portion of the BKEPs for the DAACM test program are already funded in the BKEP program under PE 64604F, Submunition Development. This is because the BKEP contract was funded originally under the MRASM programs (cancelled in August 1983), and included the test hardware for the MRASM program. In July 1985, that contract was modified to change the configuration of BKEP from a MRASM-unique system to a simpler, more reliable and producible tactical configuration or DAACM and any future weapons which may use BKEP. Therefore, the cost of the DAACM test program was reduced by these previously paid for test assets.

The DAACM test program has two major phases: first a contractor subsystem development testing, then a combined Development Test and Evaluation (DT&E)/Initial Operational Test and Evaluation (IOT&E). Contractor subsystem development and testing will include primarily the control unit, the dispensing system, and proper patterning overlay of BKEPs and HB-876s over the target. The DT&E/IOT&E will complete developmental demonstration and explore operational delivery in the secondary modes of dive, loft, and high altitude by flight testing 40 units. Milestone chart is attached.

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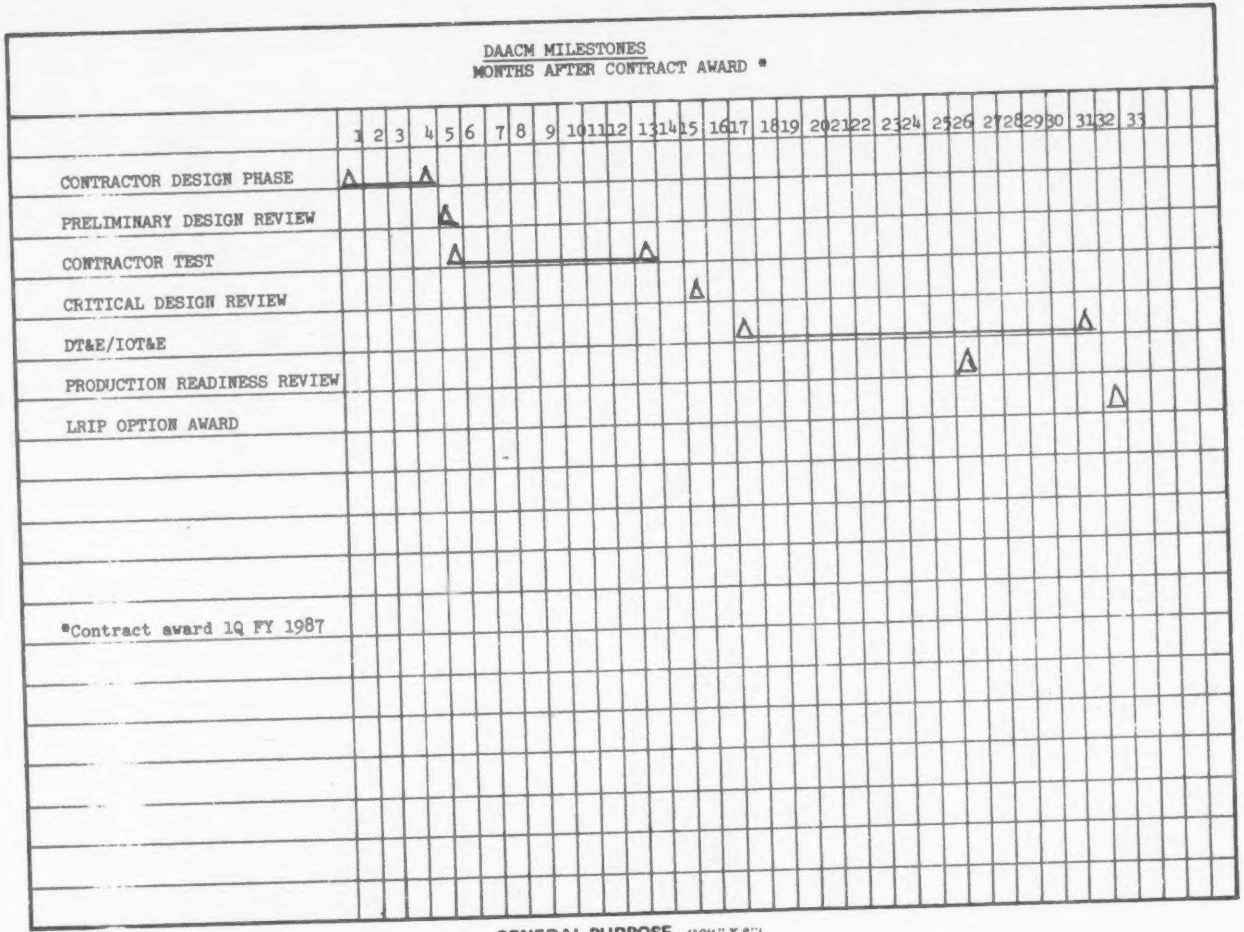
DAACM MILESTONES
MONTHS AFTER CONTRACT AWARD *



*Contract award 1Q FY 1987

AF FORM SEP 77 3138

GENERAL PURPOSE (10½" X 8")

Question. Last year, the Air Force assured the Committee that the BKEP/AGM-130B schedule was normal and that it had "high confidence" that it would be met. What confidence does the Air Force have in its DAACM schedule?

Answer. Budget constraints required us to abandon the AGM-130B before its development began, and concentrate all efforts on DAACM. Once DAACM full scale development begins, the integration effort will be a relatively low risk effort in that major components are either in production (i.e., the Tactical Munitions Dispenser, proximity fuze, and British HB-876 mine) or will be completing development (BKEP). Parts of the integration effort include the airbag dispensing system and the control unit which sequences the submunitions, both of which are existing technologies. Because of this moderate risk approach, our level of confidence in a 33 month program is high.

Question. What is the total expected acquisition cost of the DAACM loaded with BKEP submunitions? Provide for the record a funding profile, showing all development costs and quantities, by fiscal years.

Answer. The following tabulation lists funding through FY 1991. We anticipate procurement beyond FY 1991 to total approximately $1 billion. Unit production cost for the total procurement is $112,900 in then-year dollars ($85,800 in FY 85 base-year dollars).

FY 1987 PRESIDENT'S BUDGET ($ Millions)

[Dollar amounts in millions]

	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	Total
RDT&E (PE64602F)	[1] $1.7	$17.7	$10.8	$5.0	0.0	0.0	$35.2
Procurement	0.0	0,0	$13.1	$53.8	$96.4	$141.4	$304.7
(PE 28030F) Qty	(0)	(0)	(20)	(350)	(850)	(1,600)	(2,820)

[1] Includes $1.0 million reprogramming.

Question. What standoff distance will the DAACM provide for attacking aircraft?

Answer. The DAACM is primarily intended for high speed, low level overflight attack, similar to the employment of the Durandal weapon which it will replace.

The generic need for standoff is to reduce attrition. Because only one third as many sorties are required for DAACM versus Durandal employment, aircraft attrition will be significantly reduced accordingly. However, for operational flexibility, DAACM will have a limited two mile standoff capability in its loft mode, as well as dive release and level high altitude release capability, all of which are not possible with Durandal. Although these three additional modes offer greater operational flexibility and capability to employ weapons on additional aircraft, the DAACM effectiveness degrades when these additional modes are used instead of the primary of low level overflight attack.

Question. What assumption does the Air Force make for attrition rates of aircraft attacking Pact airfields with DAACMs? (We understand the Air Force cannot predict attrition rates. However, assumptions must be made for planning and analysis purposes).

Answer. While absolute attrition rates cannot be forecast, the Air Force does make allowances for certain levels of attrition in its force structure and war consumables planning. For example, the F-16 relies primarily on direct attack munitions, and the attrition rates for planning war consumables (including DAACM) in the NATO scenario are as follows ———.

AGM-130

Question. The Air Force is requesting $44.1 million to develop the AGM-130A, a powered version of the GBU-15 glide bomb. At the same time, procurement funds are also requested in the FY 1987 budget. What test flights of the AGM-130A have taken place to date? With what results? Provide for the record a detailed description of those tests, their objectives and results.

Answer. AGM-130A subsonic symmetric and asymmetric safe carriage on the F-4E was successfully demonstrated in captive carriage flights from November 8, 1985 to November 27, 1985 at speeds from .67 to .95 Mach and altitudes from 3,000 feet mean sea level (MSL) to 30,000 feet MSL.

The following AGM-130A jettison test flights have been accomplished to demonstrate AGM-130A safe separation from the F-4E:

Test No.	Objective	Parameters	Date
1	Safe Separation	.6 Mach 16,000 feet (MSL)	10 Dec 85
2	Safe Separation	.9 Mach 20,000 feet (MSL)	12 Dec 85
3	Safe Separation	.9 Mach 20,000 feet (MSL)	28 Feb 86
4	Safe Separation	.95 Mach 20,000 feet (MSL)	25 Mar 86
5	Safe Separation	.95 Mach 11,500 feet (MSL)	15 Apr 86

All tests were successful. The second flight indicated different MAU-12 bomb rack orifice settings needed to be used. The third flight verified the correct orifice settings.

The significant development funding ($44.1 million) in the same fiscal year (1987) as procurement funding gives a false impression that production is being unduly accelerated. However, only about eight percent of the fiscal year 1987 development funding is used to complete development of the basic AGM-130A missile which is being procured at low rates in that year. About 75 percent of the development funds support development of the Improved Data Link and Advanced Support Equipment which will be produced later. The remaining development funds ($7.619 million) support certification of the AGM-130A on an additional aircraft, the F-15E.

Question. Why is production contemplated concurrent with development?

Answer. Without some development/production concurrency, it would take an excessive amount of time to obtain missiles for Follow-On Test and Evaluation and initial deployment to the field. Right now, we anticipate that we will go into low rate initial production in the third quarter of fiscal year 1987 with production tooling and some industrialization improvements started prior to that time. With this approach, we can balance the risks of concurrency with the advantages of entering production at a reasonable pace.

Question. Why must the data link be improved? How much will that improvement cost? Provide a copy of the requirements analysis which established that the existing data link is inadequate.

Answer. The data link must be improved to provide a jam resistant capability for the AGM-130 weapon system in order to meet the postulated threats through the year 2000. The present data link used for the GBU-15 was not designed to be jam resistant. Operational and data link vulnerability testing has shown the need for a more capable jam resistant data link. The Improved Data Link is being developed to fill this need in the AGM-130 weapon system.

Estimated development cost for the Improved Data Link is approximately $80 million.

A formal requirements analysis for the Improved Data Link has not been performed and, thus, cannot be provided. However, the cumulative results of several independent analyses/tests provided data that substantiates the Improved Data Link requirement. The AGM-130 Threat Planning Document details the AGM-130 threat through the year 2000. Requirements for the Improved Data Link are based on numerous analyses/tests.

Question. The Air Force last year estimated that AGM-130 development would require $50.5 million, of which $15.4 million was for AGM-130B. Since AGM-130B has been cancelled, the sum of $35.1 million should be required for AGM-130A. As noted above, $44.1 million is requested. Why has the FY 1987 cost for AGM-130A gone up by $9 million, or 26 percent?

Answer. The $9 million increase in the fiscal year 1987 President's Budget results from a combination of the following actions. A new effort for certification of the AGM-130A on an additional aircraft, the F-15E, was included for $7.619 million. $3 million of basic AGM-130A missile development effort was moved from fiscal year 1986 to 1987 when the fiscal year 1986 appropriation did not reach the requested level. Finally, approximately $1.7 million of the fiscal year 1987 Improved Data Link development effort was reprogrammed to later years to more closely match annual funding with the development effort.

Question. The remaining development cost of AGM-130A for FY 1988 and beyond was estimated last year at $11.8 million. Why is that now estimated at $63.5 million? Are these cost increases indicative of serious technical problems which remain to be announced?

Answer. The increase in estimated AGM-130A development costs from the fiscal year 1986 President's Budget request to the fiscal year 1987 President's Budget request did not result from technical problems. AGM-130A estimated development funding provided in the fiscal year 1986 President's Budget for fiscal year 1986 through fiscal year 1990 (the end of AGM-130A development) was $104.849 million. This estimate funded the development of the basic AGM-130A missile, the Improved Data Link and Advanced Support Equipment. The fiscal year 1987 President's Budget estimated funding for these same fiscal years is $136.877 million, an increase of approximately $32 million. This increased amount funds new efforts to certify the AGM-130A missile on an additional aircraft, the

F-15E, (approximately $12.5 million which includes $7.619 million in fiscal year 1987) and to develop a second producer for the Improved Data Link during development so competition can be achieved and production costs lowered. Advanced Support Equipment development estimates did increase by about $1.3 million over this time period.

While the AGM-130A development funding estimate for the fiscal year 1988 through 1990 time period in the fiscal year 1987 President's Budget ($65.523 million) exceeds the fiscal year 1986 President's Budget estimate ($11.79 million) by $51.733 million in those years, approximately $19.7 million of this increase is a reprogramming of funding not appropriated by Congress in fiscal year 1986 to these later years. The remaining $32 million increase was as explained above.

PRECISION LOCATION STRIKE SYSTEM (PLSS)

Question. The Air Force is requesting $26.6 million to continue development of the Precision Location Strike System (PLSS). The intent is to locate with great accuracy enemy air defense emitters so that they can be attacked, jammed or avoided.

This program has been plagued by technical problems, cost overruns, and schedule slips. For example, the date announced to the Congress the past three years for AFSARC IIIA has slipped from September 1984 to March 1985 to March 1986. What currently is the status of PLSS? What are the problems? Is an AFSARC IIIA in fact being held this month? If not, why not?

Answer. AFSARC IIIA was not held in March 1986. The PLSS program experienced substantial cost growth during the last two years. A series of technical difficulties in the contractor conducted integration and flight test activities prevented the Air Force from proceeding with the procurement of the PLSS hardware. To save the investment in the PLSS technology for future applications, the Air Force plans to conduct Government (Air Force) controlled testing of the residual PLSS RDT&E assets during FY 1986 and FY 1987. The PLSS test assets have demonstrated substantial capabilities in precision emitter location and identification. Problems remaining to be investigated include system timing anomalies, through-put processing rate, and the ability of the software to ———. The Air Force plans to apply the $26.6 million in the FY 1987 RDT&E request to resolve these problems in the PLSS technology. Solutions to these problems will allow the PLSS RDT&E assets to be employed as a contingency system, if desired, and will provide valuable data to improve other existing or future systems.

Question. What were the originally projected costs for development and for procurement of PLSS, and what are they now?

What is the Air Force position on continuation of PLSS?

[CLERK'S NOTE.—The Department stated that the requested information would be provided under separate cover. However, as of the date of printing, the information was not received by the committee.]

Question. What other assets are there, in being or in development, which can provide a similar capability?

Answer. No other asset provides the full capability that PLSS was intended to provide. The following systems each provides some electromagnetic intelligence and/or attack capability: Senior Ruby (U-2/TR-1); Rivet Joint (RC-135); Combat Sent (RC-135); TEREC (RF-4C); SR-71 Aircraft systems; Army Quick Look (RV-1D) systems; Navy E-2C and EP-3 aircraft systems; F-4G Wild Weasel and National Systems. ——— In fact, the PLSS design was intended to overcome the short comings of the other systems.

SPACE SHUTTLE OPERATIONS

Question. The Air Force is requesting $175.9 million for Space Shuttle Operations. That program includes, among other things, reimbursement to NASA for Shuttle flights, payload integration and flight operations planning. Following the tragic loss of Challenger, a long interruption of Shuttle operations is anticipated. How much of the FY 1987 request is specifically for IUS and Orbiter Flight Charges?

Answer. In FY 87, the Space Shuttle Operations RDT&E request is for $175.9M of which $9.7M is for the Inertial Upper Stage and $32.9M is for Orbiter Flight Charges.

Question. How much of the FY 1987 request is specifically for operation of the Shuttle facility at Vandenberg AFB? What reduced level of activity is now anticipated at that facility?

Answer. In FY 87, the Space Shuttle Operations request is for $1,171.2M of which $412.5M is for the Vandenberg Launch and Landing site (VLS). The current NASA planning calls for a resumption of Shuttle Launch in Feb 87 with a launch from VLS as early as Mar 87. To meet a Mar 87 launch date requires that flight hardware begin processing at VLS by May 86. As long as this launch date is a possibility, the level of activity at VLS will not be reduced.

COMPONENT IMPROVEMENT PROGRAM (CIP)

Question. The Air Force is request ing $141.8 million for the Aircraft Engine Component Improvement Program (CIP). The purpose of the program is to investigate improvements which will lead to better durability, reliability, etc.

Last year, we asked why the Air Force necessarily had to bear the cost of engine improvements. Given the competitive environment, it seems that a contractor would bear the costs to improve his position. The Air Force replied, in part: "To expect the contractor to unilaterally bear the costs associated with configuration changes is to abrogate Air Force control over the end product." Why is that the case? Doesn't the Air Force control the end product by means of a specification? Why can't the Air Force tell its contractor what changes it requires, said changes to be at no cost to the Government?

Answer. Air Force control of an engine manufacturer's efforts and costs is achieved through a contract. Current CIP efforts are controlled with independent annual contracts which define the efforts to be accomplished. It is possible for the Air Force to control these efforts by using the annual engine production contracts. However, adding CIP type development requirements to production engine contracts through specification changes would delay production engine deliveries by up to 24 months to develop and qualify these changes. To implement this approach, accelerated Congressional funding of production engines would be required to gain the 24-month lead time so requirements can be met.

Another consideration is that the CIP funding supports many engines already in the active inventory. The FY 87 funding request will be used to improve predictions of critical engine part failure in inventory engines. Due to the potential loss of aircraft or major engine damage from critical parts failing, all parts are replaced when it is likely that a few percent could fail. In these cases, CIP develops better failure detection techniques to confirm these parts are still good and can continue in use. CIP also improves parts to yield significant maintenance cost avoidance on engines already in the inventory. A portion of the CIP funding also supports developing techniques to repair expensive engine parts so they can be returned to service rather than being scrapped.

Based upon the above benefits, we believe the current approach of separately funding CIP development efforts is desirable since it does not add development risks to new engine production contracts, does not require significantly accelerated commitments of production funds and is required to avoid increased maintenance costs on operational engines already in the inventory.

Question. In any case, what have changes in the manufactured end product to do with who bears the cost of CIP, which is, after all, simply an investigation of possible design changes? How much of their own funds, and of IR&D funds, do engine manufacturers now spend on CIP of their products?

Answer. The contractor bears the costs of developing and qualifying changes to the end product if the contractor unilaterally changes the end product in an attempt to achieve a competitive advantage. If the Air Force requires changes, CIP pays for developing and qualifying those changes to the end product. CIP involves much more than just an investigation of possible design changes. It also involves the actual redesign of parts, extensive testing (proof and investigative), introduction of new technology developed elsewhere, analysis/recommendations concerning maintenance practices, etc. IR&D is for generic research and development and cannot be used to support current equipment/effort under contract or grant and is not to be used for CIP type effort. The only funds that the contractor has are those funds that are available from the sale of his product or service. The Air Force specifically refuses to allow the inclusion of engineering support other than production support, in the price of engines. Therefore, the only funds available to the contractor for this effort are the CIP funds we provide. While we cannot verify the exact amount, it is our understanding that the engine contractors include between 5% to 10% for CIP type engineering support in their commercial sales price of engines and spare parts.

Question. Provide for the record a listing of all engines funded for CIP in FY 1985 through FY 1988. For each engine, show the amount of funding for each fiscal year. For each engine, state the number now in service, the aircraft they power, and the year they entered service.

Answer.

[Dollars in millions]

Eng	FY85	FY86	FY87	FY88	In service (As of Mar. 86)	Aircraft	Year entered service
F100	$51.7	$31.695	$42.410	$44.240	3,510	F-15,F-16	1973
F101	42.47	31.630	42.650	42.280	111	B-1B	1983
F110		6.841	14.786	15.892	5	F-15, F-16	1986
TF34	13.205	8.880	10.140	9.130	1,554	A-10	1972
TF41	5.198	4.230	4.900	4.500	561	A-7	1969
J85-21	0.761	0.700	0.740	0.700	257	F-5E/F	1072
TF33	2.619	1.980	2.500	2.600	3,389	B-52, E-3A, C-141, EC/RC/C-135.	1960
J57	0.190	0.200	0.150	0.120	6,610	B-52, C/EC/RC/KC-135	1957
J79	1.119	1.187	1.200	1.160	4,024	F-4	1957
T58	0.139	0.195	0.150	0.150	335	UH-1, CH-3, HH-3	1960
T64	0.140	0.195	0.150	0.150	135	CH-53, HH-53	1963
TF30	12.071	10.333	8.380	7.830	1,094	F/FB-111	1967
J69	0.707	0.330	0.350	0.350	1,436	T-37	1959
J85.8STG	3.360	4.180	2.500	1.500	2,400	T-38, F-5, C-123, A/AO-37.	1962
T56	2.362	2.610	2.600	3.100	3,849	C-130	1956
T400	0.106	0.100	0.110	0.110	198	UH-1	1970
TF39	4.802	4.420	4.640	4.450	468	C-5	1969
GTUs[1]	2.166	1.980	1.900	1.470	5,129	All Systems	
T76	0.128	0.113	0.120	0.150	250	OV-10	1967
T700	0.32	0.400	1.200	1.000	26	HH-60	1976
F109			(2)	(2)	0	T-46	1987
Travel and Mission Support	0.676	0.381	0.424	0.424			
Total	144.239	112.577	141.8	141.306			

[1] Gas turbine units.

[2] If the ten T-46 aircraft procured in FY86 enter the operational inventory, CIP funds will be diverted from other engines to ensure T-46 safe flight.

Note.—The actual funding applied to specific engines in the current and future years will vary slightly if some engines experience unexpected operational or safety problems.

VERY HIGH SPEED INTEGRATED CIRCUIT PROGRAM (VHSIC)

Question. The Air Force is requesting $132.9 million to continue the Very High Speed Integrated Circuit program. Last year, the Air Force projected that $158.2 million would be required. Air Force documentation states that the $25.3 million decreases "resulted from reduction of Air Force TOA." Does that mean that VHSIC now has a lower priority? What does it mean? Please reconcile a 16 percent reduction in the FY 1987 request for VHSIC with a 32 percent increase in the total FY 1987 R&D request of the Air Force.

Answer. Regarding the R&D request increase—the proper percent is 21, not 32. Further, the RDT&E line increase is driven by planned development of new strategic systems—small ICBM, ATB, Milstar, etc.

[Clerk's note.—The amount available for Air Force RDT&E for fiscal 1986 after Gramm-Rudman-Hollings reductions were applied is $13.046 billion. The fiscal year 1987 request is $17.275 billon, an increase of 32.4 percent.]

Now, regarding the VHSIC question, we offer the following . . . VHSIC continues to be one of the Air Force's high priority Science and Technology efforts. The reduction in the FY 1987 request merely reflects a restructuring of the VHSIC submicron technology program (second generation VHSIC) to more appropriately align with projected technology needs dates. The Air Force conducted an extensive review of projected system needs for VHSIC submicron technology last year. We found that there were no requirements until at least the mid 1990s, a fact which did not support the previously planned pace of the submicron effort. On that basis, the Air Force restructured the submicron effort, and reduced the FY 1987 request accordingly.

Question. Last year, the Air Force stated that the submicron part of VHSIC would end in FY 1988 with delivery of chips, brass boards, pilot fabrication lines, and associated technology and data. Why does FY 1987 documentation now show this second generation efforts as lasting until FY 1991? What will this longer time add to the cost of the program?

Answer. Last year, the Air Force conducted an extensive review of system needs for VHSIC submicron technology. We found that there were no projected requirements until at least the mid 1990s, a fact which did not support the previously planned pace of the submicron effort. On that basis, the Air Force restructured the submicron effort. Although the program now extends through FY 1991, we do not expect the overall cost to increase beyond current projections.

TUESDAY, MARCH 18, 1986.

NAVY RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

WITNESSES

HON. MELVYN R. PAISLEY, ASSISTANT SECRETARY OF THE NAVY, RESEARCH, ENGINEERING AND SYSTEM

VICE ADMIRAL ALBERT J. BACIOCCO, U.S. NAVY, DIRECTOR, RESEARCH, DEVELOPMENT AND ACQUISITION

MAJOR GENERAL RAY M. FRANKLIN, U.S. MARINE CORPS, DEPUTY CHIEF OF STAFF, RESEARCH, DEVELOPMENT AND STUDIES

RICHARD RUMPF, PRINCIPAL DEPUTY TO ASSISTANT SECRETARY OF THE NAVY (RE&S)

JAMES E. GAINES, OFFICE OF THE ASSISTANT SECRETARY OF THE NAVY (RE&S), DIRECTOR, ACQUISITION MANAGEMENT, INTERNATIONAL PROGRAMS AND CONGRESSIONAL SUPPORT

HUBERT WANG, OFFICE OF THE ASSISTANT SECRETARY OF THE NAVY (RE&S), DIRECTOR FOR STRATEGIC PROGRAMS

NANCY S. STEHLE, DEPUTY DIRECTOR FOR ENVIRONMENT, OFFICE OF THE ASSISTANT SECRETARY OF THE NAVY (S&L)

JOHN J. KEANE, DIRECTOR, OFFICE OF THE ASSISTANT SECRETARY OF THE NAVY (RE&S), SUBMARINE/ASW PROGRAMS

RICHARD E. METREY, OFFICE OF THE ASSISTANT SECRETARY OF THE NAVY (RE&S), DEPUTY ASSISTANT SECRETARY OF THE NAVY, SURFACE WARFARE PROGRAMS

INTRODUCTORY REMARKS

Mr. CHAPPELL. The committee will please come to order. Pursuant to a motion duly made and passed, this hearing will be in executive session because of the classification of the material to be discussed.

This morning the committee will hear testimony on the fiscal year 1987 request of the Navy for research, development, test and evaluation funds. That request totals $10.6 billion, which represents an estimated 7 percent in real growth over the fiscal year 1986 appropriation as adjusted by Gramm-Rudman-Hollings deficit reduction legislation.

We expect to cover a number of programs this morning, including the SSN-21 submarine, the advanced lightweight torpedo, and the V-22 Osprey.

We welcome as principal witnesses Mr. Melvyn R. Paisley, Assistant Secretary of the Navy for Research, Engineering and Systems; Vice Admiral Albert J. Baciocco, Jr., U.S. Navy, Director of Research, Development, Test and Evaluation for the Chief of Naval Operations; and Major General Raymond M. Franklin, United States Marine Corps, Deputy Chief of Staff for Research, Development and Systems.

The committee also wishes to welcome Mr. Richard L. Rumpf, who appears before the committee for the first time as a back-up witness in his new capacity as Principal Deputy to Mr. Paisley.

Welcome, gentlemen. Your entire statements will be made part of the record. If you would like to summarize them briefly, please proceed.

SUMMARY STATEMENT OF MR. PAISLEY

Mr. PAISLEY. I examined the testimony of the Secretary, the CNO and the Commandant so I know some of the questions you have asked them.

We have an understanding of some of the questions that you have to ask. I brought a number of my staff with me and I am going to try to answer every question that you ask me. I will try to take no questions for the record. We will try to answer on the spot. The exception to that is if there are any operational questions that might come up which are not R&D, we will have to take those for the record and handle them through our operational people.

The main accomplishment for this year, giving credit to the years of pressures, concerns and advice from this committee, has been to release an acquisition policy that we think is going to make major strides in the Navy. In fact, I believe that the rest of the Department might adopt the policy. The important things that we have in that policy are the increased use of competition; the early use of fixed pricing, in fact that is specifically spelled out for the R&D cycle; and increased contractor investment.

We have gone from two extremes where we had maximum risk to the contractor by having a total package procurement approach to the other of minimum risk to the contractor by having a cost plus approach. We think we now have a balanced R&D policy that has minimal risk for both the government and the contractor.

We have successfully applied this policy on many programs. I would like to mention a few of them because questions come up as to whether we have any data to verify the results of our policy.

The A-6F, the F-14D, the T-45, the V-22 (both the engine and the airframe) the CG-47 and the Vertical Launch System, are examples of programs that verify the data. They were the types of programs sort of things that we normally would have started as cost-plus contracts or fixed-price incentive contracts.

If you add up the estimated cost of these programs at the time we started, they come to about $5.6 billion.

We have been able to put all those programs on fixed price contracts at $1.5 billion less than originally estimated. We have reduced the risk, reduced the amount of money and we have an investment on the part of the contractors.

I will give specific data on each program to the stenographer and you can incorporate it into the record.

[The information follows:]

[In millions of dollars]

Program	Fiscal year 1984	
	Initial cost estimate	FFP contract
A-6F	$500	$350
F-14D	950	750
T-45TS	870	438
V-22 engine	185	89
V-22	1,645	1,520
CG-47	1,200	900
Vertical launch system	288	199

Mr. PAISLEY. A question often asked of me, so I anticipate you will be asking it, do you have any priorities? Can you give us any programs you can cut?

It is always nice to be able to say yes, here is one that we did cut. Seafire, we have stopped that program.

What I would really like to say to you, however, in my view, is that the highest priority programs in terms of funding are all of our fixed price programs. When you fix-price a program, you can't afford to cut it. If you do, it is going to cost you more money than you originally planned. So our highest priority will always be to fund fixed-price programs where the contractor has stepped up, understands the risk, and we have stepped up and funded it. We will try to, throughout our budget, continually protect all fixed-price contractors.

With that I would like to rapidly enter into your questions, because I know that you have a lot of them. As I said, I have a number of key people here so that we should be able to answer almost all the questions right here.

With that I would like to open it up to questions from the committee.

[CLERK'S NOTE.—Mr. Paisley's classified statement was submitted for the committee's files.]

[The unclassified statement of Mr. Paisley follows:]

INTRODUCTION

Mr. Chairman and members of the Committee, I am pleased to appear before this subcommittee again to present the Navy's FY 1987 research and development program and budget. With me today at the table are: Vice Admiral Albert J. Baciocco, Jr., United States Navy, Director, Research, Development and Acquisition for the Chief of Naval Operations; Major General Ray "M" Franklin, United States Marine Corps, Deputy Chief of Staff for Research, Development and Studies; and Mr. Richard L. Rumpf, my Principal Deputy. My statement is structured in two parts. The first part discusses our accomplishments in the Navy's Research and Development program. It then discusses the technology base that underlies the Navy R&D program and the manner in which we insure that the R&D program supports our maritime strategy in responding to the threat. It closes with an exciting report on initiatives we have begun to better mobilize America's industrial capability. The second part gives examples from our mission areas of programs in the R&D budget that support this strategy and show our efforts to inject better management and accountability in all programs.

.I.

ACCOMPLISHMENTS IN THE NAVY R&D PROGRAM

Never since the days of Theodore Roosevelt have the Navy and Marine Corps exhibited such a strong consensus on the comprehensive strategy which now forms our naval planning for research and development. We have stopped chasing R&D rainbows. The FY 1987 request for RDT&E is $10,586.8M, 10.2 percent of the Navy's total request. It represents the accomplishment of the pledge made five years ago to inject better management into our R&D programs; to increase funding when there is a high operational payoff at affordable cost; and to study ways to better mobolize America's industrial capability.

R&D MANAGEMENT

To insure that this research and development base is managed cost effectively, the Navy has injected better management into our R&D programs by initiating a number of reforms in the acquisition process that affect both R&D and production. The success these initiatives have shown in reducing cost has gained them considerable Congresssional support. I am thinking particularly of Senator Goldwater's hope that the other military services would follow the Navy's example, especially with regard to competition. These reforms are the product of five years' work, and resulted in a new acquisition policy issued last November.

The ultimate goal of the Navy acquisition process is to achieve improved performance and increased reliability at lowest reasonable cost. We must begin this effort in R&D as it sets the stage for the entire procurement cycle. I believe we can do this through:

- greater use of competition

- earlier use of fixed-price contracts in the R&D cycle; and

- increased contractor investment.

Our new acquisition policy provides a better management tool for ensuring a controlled transition from development to production. We have already begun to see encouraging progress as a result of these measures.

We are also reemphasizing the role that our allies can play in contributing to our R&D efforts.

The New Navy Acquisition Policy

Let me describe our new policy to you. The development cycle of each program begins with a minimum of two contractors performing concurrent, but separate development up to Full Scale Engineering Development (FSED). This pre-FSED period will include risk reduction, specification streamlining, and cost-capability tradeoff efforts. The objective of these activities is to clearly identify and eliminate those capabilities which provide only marginal military worth when compared to costs and risks.

At the beginning of the FSED period, the contractor field will be competitively narrowed to two contractors developing a system to one design. We will not continue to a Milestone II decision to proceed with FSED until we are satisfied that advanced development has reduced risk sufficiently to enable the contractors to commit to a fixed price type contract that includes not-to-exceed prices or priced production options. These provisions may be waived, however, when the urgency of the operational requirement for a given system dictates that we proceed with risks that would be considered excessive under normal circumstances.

The first limited production buy will be split between the contractors so that each will have the capability to compete equally for rate production.

Once production has been approved, contractors are expected to provide production tooling and test equipment, with the exception of acceptance test equipment, as well as those facilities required for program execution. Recovery of these investment costs will be accomplished through depreciation and program-related profit in a mutually-agreed business arrangement. Exceptional circumstances, such as the modification of existing Government-owned tooling and test equipment, may require other equitable business arrangements. These recovery methods are similar to those used in the commercial market today.

To ensure effective implementation of this acquisition policy, changes in programs, both in R&D and in production, must be kept firmly under control. Necessary changes in design must be made sparingly. Changes or modifications causing a change to baseline or performance characteristics and which result in a cost increase will be presented for review in accordance with the Navy's Program Management Proposal Process. For systems in production and for those already deployed we will make only block upgrades. Exceptions will be made for safety.

All fixed-price contracts must be fully funded in the POM. Solicitations and contracts will be streamlined to eliminate over-specification and unnecessary requirements. We have an excellent example of the results of our efforts to eliminate over specification. I directed the Navy Specification Advocate General to review the High-Frequency Anti-Jam (HFAJ) Program with a view toward deleting unnecessary specifications. I am pleased to report that this exercise led to deletion of approximately 225 pages of unnecessary specifications, or a 30% reduction.

Gold-plating must be controlled throughout development and production. Off-the-shelf equipment and non-developmental items will be used, whenever practical, to save costly research and development investment. Commonality of parts is required and must be maximized at the subsystem/component level. The larger quantity buys that will result from this commonality will lead to an increased competitive base and greater savings to the Government.

Systems commanders are responsible for the successful implementation of their assigned programs and, as such, will be held accountable. Mismanagement, overspecification and inefficiency must be identified early and eliminated. Micromanagement must be discouraged to the maximum extent possible.

The establishment of the Material Professional community has played an important part in providing a viable career path for those working in acquisition and procurement. Since we established the Material Professional commu community slightly over a year ago, over 900 Officers, from Commander to Admiral, have been so designated. Approximately one-third of our Flag Officer billets are now set aside for Material Professionals. This year's Rear Admiral selection board reflected this fact. We are rapidly building a professional force with the education and experience required to make our acquisition managers capable, skilled business professionals with the warfare background necessary to properly manage weapons systems. To keep this program on track, no procurement or acquisition billet may now be filled by other than a Material Professional without a personal waiver from the Secretary of the Navy.

We are now more frequently rewarding program managers and other acquisition personnel who demonstrate superior performance. Acquisition managers are encouraged to maximize communications within the Navy, with OSD and with the other services to eliminate redundancy and to increase quantity buys. This will result in greater competition and lower costs. Managers are also encouraged to be creative and to consider alternate acquisition strategies for unique programs when they feel their approach will be more beneficial to the Navy than those I mentioned earlier.

We must ensure:

- that cost-capability tradeoffs are examined and that performance requirements that yield only marginal benefits are eliminated;
- that the program's acquisition strategy provides for maximum effective, sustainable competition;
- that the development specifications are tailored to the operational requirement; and
- that the hardware and software development reflects maximum practical commonality.

Fixed-price R&D contracts have resulted in substantial cost avoidance for the Navy. The original price estimates of the V-22, T-45TS, F-14D, and the A-6F upgrade totalled over $4.1 billion. The actual fixed prices for these programs totalled $3.1 billion. Cost avoidance amounted to more than $1 billion.

CHART #1

Let me provide another example of how our new approaches have benefitted the Navy. In a recent case involving a major Navy program, Secretary Lehman stated that he wanted to use a second source and increase competition. The original contractor, upon learning of Secretary Lehman's intentions, gave the Navy a very competitive price in its attempt to keep the contract and prevent the Navy from going second source. The point is that just the threat of competition can keep prices down.

It is interesting to note the difference between the forecasted cost of a program and its actual cost. Consider the CG-47 Program. Analysts predicted that bringing in a second source from FY-1982 thru FY-1985 would cost the Navy $437 million. The actual cost of bringing in a second source over that same period was a savings of $728 million. The overall difference between the predicted and actual costs was $1.1 billion.

When we consider another program, the surface ship Vertical Launch System (VLS), the overall cost savings has been over $250M after just two years of competition. The point is that it is impossible to predict the cost effects of competition. It is clear, however, that second source programs are a good risk. Every Navy program using second sourcing has paid off and resulted in significant cost avoidance.

In summary, our acquisition policy has been recently reviewed and modified and incorporates several changes designed to make the acquisition process more efficient. Greater use of competition, increased contractor investment and earlier use of fixed-price contracts help reduce costs and enhance the production process. The policy benefits all participants in the acquisition process. It encourages investment and modernization on the part of contractors and enhances the quality of products and services provided to the Navy.

Allied Contributions to Navy R&D

To turn to the benefit we derive from complementary NATO R&D efforts, let me briefly discuss some of our cooperative programs. The Navy has reinvigorated its consultations with NATO armed forces for them to assist in establishing operational and design requirements for new weapon systems. Navy acquisition planners are also required to consider the capabilities of NATO allies to satisfy US requirements before any new development work is begun. In the case of equipment not requiring R&D, naval equipment planners are required to assess the feasibility of filling material requirements by purchasing existing equipment from NATO allies.

Navy competition advocates are also required to consider NATO industrial services for equipment before approving acquisition strategies for new equipment or justifying anything other than open competition. Every acquisition plan now developed by the Navy must have a separate section devoted to NATO armaments cooperation.

These initiatives amplify previous ongoing cooperative efforts such as the NATO Conference of National Armaments Directors as well as other NATO discussion groups, Data Exchange Agreements and Information Exchange projects, the Technical Cooperation Program, and the Foreign Weapons Evaluation Program. Many of the programs I discuss later in my statement testify to our successes in joint development and cooperative programs with NATO and our other allies.

HIGH OPERATIONAL PAYOFF AT AFFORDABLE COST

In the Gramm-Rudman-Hollings era, it is incumbent upon us to better manage programs so as to reduce costs wherever possible. It is also important to choose carefully those programs where there is a high operational payoff at affordable cost.

Many in the defense community believe that the United States and its allies will never be able to match the Soviet Union's quantitative superiority in weapons. These same individuals feel that our only hope lies in a qualitative superiority achieved by the fullest exploitation of our technological prowess. Taken to the extreme, this concept leads to the development of weapons that are not merely smart, but positively brilliant. In my opinion, such a relentless pursuit of technological sophistication has the danger of making weapons unaffordable. We cannot ignore the increasing sophistication of enemy forces, yet we cannot allow excessive sophistication at exorbitant cost to undermine our ability to procure an array of weapons sufficient in number and type to meet the threat.

In the Navy research and development program, we have resolved this dilemma by dedicating ourselves to two kinds of programs that have a high operational payoff at affordable costs: those that make use of sophisticated, leading edge technology and those that are innovative applications of less sophisticated technology. We have found that sophistication for its own sake buys us very little. On the other hand, intelligently applied technology has reaped significant dividends.

Sophisticated, Leading Edge Technology

The F/A-18 is a good example of the benefits of sophisticated, leading edge technology. The heads-up display and digital presentation of information in the F/A-18 cockpit is an application of sophisticated technology that has revolutionized cockpit design. Both of these features are incorporated in upgrades of all Navy tactical aircraft. They greatly diminish pilot workload and are particularly important in a multi-mission, single seat aircraft.

In addition, the incorporation of built-in test features in the F/A-18 weapon system as well as in most of its avionics simplifies not only the pre-flight check of the aircraft, but also the maintenance of individual components. The aircraft essentially checks itself before flight. For components that fail, their built-in test features allow maintenance personnel to rapidly diagnose the defects causing the failure in order to take corrective action.

All of this has occurred at prices that are steadily moving downward as we get up on the learning curve and stabilize configuration. The flyaway cost of the F/A-18 has decreased 16.9 percent in constant dollars (32 percent in FY 1982 dollars) since its initial production in 1982--and this statistic does not reflect the decreased spare part, test equipment, and personnel requirements resulting from the F/A-18's superior maintenance and reliability record. This example points out the fact that life cycle returns on investment in sophisticated technology are often a better measure of the investment in this technology than is the initial short term yield.

Moreover, it is impossible to quantify the benefit of lessons learned in the F/A-18 that are being applied to our A-6F and F-14D upgrade programs. In addition to incorporating many of the same features in the cockpits of the A-6F and F-14D that were so successfully introduced in the F/A-18, we have also incorporated many of the same avionics in these aircraft. The gains in commonality are impressive. Over fifty electronic units on the A-6F have part numbers identical with either the F-14D or the F/A-18. Twenty-nine of these units are identical on all three aircraft models. Common items include mission computers, navigation sensors, displays and communications equipment.

Another example of advanced technology yielding splendid results is the AEGIS weapons system. The recently deployed AEGIS system integrates advanced weapons components to create a superior system for AAW warfare battle management. The AEGIS system is a prime example where the increased upfront cost of incorporating advanced technology reduces the total life cycle cost and provides increases in the effectiveness of the battlegroup. The subsequent life cycle cost reductions resulting from manning reductions, increased reliability, reduced spare parts costs and reduced maintenance are equally impressive.

This past year we completed the necessary testing of the second generation AEGIS SPY-1B radar. It has improved performance as compared to the SPY-1A, which is installed on earlier AEGIS cruisers, against high-altitude, high-speed targets. Full production has been approved for this radar to support installation on CG's 59 through 73.

We are actively pursuing second sourcing the AEGIS integration effort and the six hardware subsystems (director, FCS transmitter, 400 Hz convertor, SPY transmitter, SPY antenna and signal processor) that constitute the AEGIS radar weapon system. With the exception of the signal processor, all hardware subsystem second sourced contractors will be selected in FY 1986. Annual procurements will be on a competitive basis after each of the hardware second source suppliers have been selected.

Total up front cost benefit to the Navy based on the advanced technology of the SPY-1B upgrade coupled with hardware and weapon system integration competition will provide a most cost effective AAW system. Because the combat systems employed in the AEGIS cruiser and the new AEGIS destroyer are basically the same, cost benefits can also be expected from the large number of common systems used in the existing CG-47 and forthcoming DDG 51 class ships.

Innovative Applications of Less Sophisticated Technology

Let me now turn to innovative applications of less sophisticated technology. One of the best examples showing that high pay off solutions need not be complex, expensive, or sophisticated is the Low Cost Sonobuoy (LCS). The LCS is an inexpensive and innovative solution to our dual problems of decreasing Soviet noise levels and increasing numbers of Soviet submarine deployments.

LCS had to be inexpensive so that it could be used in sufficient quantities to be effective. Its design results in decreased unit cost and simplified requirements allow less expensive sonobuoy packaging and fabrication. An operational advantage is realized in increased area coverage since the aircraft is no longer limited by its sonobuoy receiver channels. The aircraft can monitor hundreds of LCS's under reduced operator and avionics workload. The LCS is a simple solution to a complex problem with potentially profound results.

Another example of a smart, simple solution is our acquisition of remotely piloted vehicles (RPVs), program which is also noteworthy for its extremely streamlined, responsive acquisition strategy.

Our interest in RPVs is a direct result of the 1982 and 1983 Israeli incursions into Lebanon, during which RPVs yielded excellent results. As such, this program is a good example of our eagerness to assimilate lessons learned - even from our allies' operations.

We are using a unique two-step acquisition strategy to rapidly field RPV systems at a minimum cost. Instead of the standard development approach, which can take several years to field a new capability in the fleet, we are accepting the performance of off-the-shelf RPV systems that meet the fleet's urgent need. Industry was asked to rapidly provide, at minimum cost to the Navy, their systems for Navy competitive testing. The selected systems will be used by the fleet immediately to develop tactics, determine the quantities we need, and analyze the capabilities required in any follow-on development. It may turn out that the initial off-the-shelf systems are adequate for the long term requirement except for improvements or additions to the sensor packages. This concept has given us a fly-before-you-buy approach which is always desirable when affordable.

THE NET ASSESSMENT

What has been the net effect of the measures we have taken to inject better management into our R&D programs and to increase funding when there is a high operational payoff at affordable cost?

To begin with, our request for $10.6 billion is a $700 million reduction from our FY 1986 request, and while our RDT&E request for FY 1986 was 10.8 percent of the Navy's Total Obligational Authority (TOA), this year it has been reduced to 10.2 percent of the Navy's TOA.

Money is spent for three major activities: the Technology Base (basic research and exploratory development), Development (advanced development, engineering development, and operational support), and Management Support. The Technology Base is 8.1 percent of the overall R&D program. It provides fundamental knowledge and new technologies that find a wide range of applications and generate concepts for new systems. The largest share of resources, 86.4 percent, is devoted to the development of platforms and weapon systems. The remaining 5.5 percent is used to pay for management support in the operation and maintenance of R&D ships and aircraft, test ranges, laboratories, facilities, and other areas necessary to support our RDT&E programs.

The following chart illustrates these statistics.

CHART #2

The allocation of funds over these three areas is roughly proportionate to our allocations last year, but the actual dollars allocated to each activity have been reduced -- a tribute to the better management of our R&D programs.

Finally, our commitment to increase funding only in those programs where there is a high operational payoff is obvious in the steady decline in the total number of Navy R&D programs in the last five years.
The following table shows this scorecard.

NUMBER OF NAVY R&D PROGRAMS

FY 83	FY 84	FY 85	FY 86	FY 87
532	507	421	415	395

We are particularly proud that we have accomplished this reduction in the number of Navy R&D programs while still fostering the dynamic, responsive research base that is so essential to the development of creative solutions to real threats.

THE TECHNOLOGY BASE

An adequate research and exploratory development base underlies all high payoff systems. A dynamic, fertile research and development base is one of our most potent weapons in this age of violent peace. To support our research and technology endeavors, the Office of the Chief of Naval Research

(OCNR) sponsors a broad based research (6.1) and exploratory development (6.2) program which provides the foundation for future technology options. Technological solutions impacting fleet systems today are available because of prior investment in this technology base.

THE OFFICE OF NAVAL RESEARCH (ONR)

The ONR program will include accelerated efforts on remote ocean sensing and related data assimilation, ocean modeling and field measurement programs. Precise knowledge of oceanographic conditions and their effects on sensors and weapons forms the underpinning of future advances in surface and anti-submarine warfare. Synthetic aperture radar systems have already identified important ocean patterns that cannot be discerned by direct surface measurement. Advanced instruments and synthetic aperture radar systems will be used to provide a synoptic view of the ocean as well as a focused view of ship wakes and other fine scale structures. Such approaches promise to revolutionize remote sensing for optical observations and systems integration at the very low light levels. Recent ONR support of the discovery of the Titanic represented a dramatic demonstration of emerging capability in this area.

Last year the Secretary of the Navy, as part of an effort to revitalize Oceanography directed the following initiatives: the establishment of the Institute of Naval Oceanography; an expansion of graduate fellowships in ocean sciences; an increase in the number of academic chairs in oceanography; and the strengthening of the ocean sciences research and exploratory development program. Each of these goals has been met. The Institute for Naval Oceanography was established on the first of October 1985 in Bay St. Louis, Mississippi. Addiitional graduate fellowships and chairs of oceanography have been established. The technology base was refocused and increased. As a result, the FY 1987 commitment is also budgeted to increase by aproximately six percent.

Major-thrusts will continue in submicron electronics, biotechnology, hydrodynamics and drag reduction. Extensive programs in materials research, including light-weight, tough and inexpensive composites have been revitalized with focused initiatives. Comparable thrusts are planned across the spectrum of ONR's broad program covering Navy relevant research in the physical, engineering, environmental and life sciences.

In clear testimony to the quality of Navy research programs, the 1985 Nobel Prize for Chemistry was awarded to Dr. Jerome Karle of NRL, for his far-ranging work in developing direct methods for the determination of crystal structures.

In FY 1986 ONR established a new program element, the University Research Initiative (URI), to address constraints on the ability of U.S. universities to perform basic research and to train the nation's future scientists and engineers. Funds for the Navy URI will be doubled in FY 1987. Strong emphasis will be placed on initiatives that encourage University/Naval laboratory interactions.

THE OFFICE OF NAVAL TECHNOLOGY (ONT)

The Navy has restructured its 6.2 program and reorganized its management. Program elements (PEs) have been reduced from 21 to 14 and now correspond to mission areas; program objectives now respond to the war fighting objectives of the Navy's Maritime Strategy; and ONT now provides direct block funding to performers, thereby eliminating a large management layer, and reducing the number of administrators from hundreds to a few dozen.

A major share of ONT's 6.2 investment is aimed at countering the rapidly expanding undersea threat. For example, we are accelerating final development phases of a new warhead--corner-stone of the MK-50 torpedo P^3I program, in order to provide the lethality needed to deal with the new Soviet submarines; pursuing jointly with DARPA advanced concepts such as advanced warheads; and initiating a joint program with the Department of Energy for development of the next generation undersea weapons.

Technologies are being developed to meet the increasing effectiveness, sophistication and proliferation of threats to AAW/ASUW/STRIKE operations, including technologies for stand-off weaponry and for a family of improved target acquisition sensors. Multiple-target warhead and fuze technologies will reduce costly inventories and cost per kill.

EW, CC^3I and C^3I technologies are being developed to counter the proliferation of sophisticated threats and the severe jamming environment which are expanding operations into new regions of the electromagnetic spectrum.

THE ADVANCED TECHNOLOGY DEMONSTRATION PROGRAM

To promote the transition of technologies from tech base programs to Navy systems, I have established the Advanced Technology Demonstration (ATD) program in FY 1987. It is of major significance to the Navy's technology base in that a technology, if successfully demonstrated, would have a transition window to a development program. The intended effect is to demonstrate the feasibility of technologies that are less mature or more risky than an individual program manager would be able to support.

The FY 1987 program contains the following projects:

- o an ultra-low loss fiber optics demonstration project which will, if successful, allow major performance improvements and cost reductions in advanced Navy systems;
- o a fiber optic missile guidance demonstration;
- o an undersea weapons technology demonstration of quiet energy sources and propulsion concepts that could offer a major reduction in torpedo radiated noise levels; and
- o a conventional munitions technology program designed to demonstrate new missile warhead and fuze options to defeat future air targets.

In the aggregate, the ATD program is designed to identify and exploit emerging technologies and to accelerate their introduction into fleet systems.

TEST AND EVALUATION

All Navy systems undergo thorough testing by the Navy to assure that they will function as required at the appropriate time. Last year the achievements of Navy's independent test and evaluation agency, the Operational Test and Evaluation Force were presented. We are continuing to build on an enviable reputation by instituting innovative ways to test high reliability equipment with extraordinarily long mean-time-between-failure rates permitted by emerging technology. Such steps will continue to ensure that new, warranted equipment like the Carrier Aircraft Inertial Navigation System (CAINS) II can be adequately tested without spending the time required to ensure it meets required failure criteria. Getting a proven product to the fleet as rapidly as possible remains our goal.

The Navy test and evaluation ranges and facilities continue to provide the wide range of services required for the proper support of test and evaluation. Our Improvement and Modernization (I&M) program continues to be planned and funded to ensure these facilities will continue to meet the test resource requirements of future weapon systems.

At all the ranges, a major facet of the I&M program is the OPSEC secure communications program. We have initiated a program to enhance our ability to protect weapons systems test and performance data. One phase of this affordable and comprehensive program provides for the encryption of data and telemetry and prevents the enemy from collecting the data that would allow easy and cheap replication or low-cost production of effective countermeasures.

The Department of Defense Director of Operational Test and Evaluation (OT&E) also plays a very important role in supporting our own test and evaluation program. Two Memoranda of Agreement detail procedures for approval of the adequacy of Navy test plans by the Director of OT&E and the observation by personnel assigned to the Director of OT&E of Navy operational tests.

MATCHING R&D PROGRAMS TO THE MARITIME STRATEGY

The Navy's maritime strategy sets the basic direction for our R&D efforts. Execution of this strategy against the Soviet Fleet's bastions, defending Norway and supporting NATO and our Pacific and other Allies has shown the need for increased capabilities in ASW, stand-off and anti-radiation weapons, aircraft and ship survivability, command and control and amphibious assault. The Navy's support of national policies toward the third world, low intensity conflicts, anti-terrorism and other crisis response requires increased capabilities in special warfare, remotely piloted vehicles, low cost accurate gunfire support, surveillance and intelligence. We are striving for commonality in these areas with the other services and our Allies for both force multiplication and cost reduction.

KNOWING THE THREAT

Many challenges and imponderables confront us as we try to match our research and development initiatives with the requirements of our maritime strategy. Since the threat is constantly evolving, our R&D initiatives must respond to short term and longer term changes in the threat. At the same time, we should endeavor to use our R&D efforts to make systems presently deployed as effective as possible. This means that at any given time, we are applying R&D to developing and evaluating new fleet and platform level tactics to counter the present threat and we are launching efforts to contend with the future threat we predict. These challenges are not insurmountable because of the nature of fleet operations which allow us to operate against the enemy day in and day out. It is in this way that we know the threat intimately, and derive from this knowledge what our maritime strategy and supporting tactics must be.

THE PRESENT THREAT

Our battlegroups observe the operations of Soviet task forces, including Kiev-class carriers. Our aviators make regular contact with Soviet aircraft. From these encounters we gain valuable intelligence on Soviet electronics and avionics systems--radars, jammers, electronic warfare receivers.

Fleet exercises and wargaming are important adjuncts to these operational inputs in that they allow us to develop tactics to counter the threat and also point up our own vulnerabilities. In 1985, the Navy conducted 86 major exercises, involving 55 allied countries. In these and many other ways, our day-to-day operations at sea and in situation rooms give direction to our R&D efforts.

PREDICTING THE FUTURE THREAT

What about predicting the future threat? Not only must our R&D effort strive to counter any present threat, it must try to anticipate new threats before they are revealed to us. If we are not successful, our fielded responses to new threats will always be 10-15 years behind. In no other area is this more evident than in the field of electronic warfare where the parametric data--not merely functional capability--is required to counter the threat. This effort is additionally complicated by the fact that many of the electronic threat systems deployed only reveal their operating parameters when used in a very controlled environment. To counter these "undefined or unexploited threats," we must embark on R&D efforts which result in systems that are responsive to projected or technically feasible threats.

A great emphasis is placed on all of our intelligence assets to obtain the most accurate data and projections as to where the threat is evolving. Additionally, the intelligence community provides feedback as to "fixes" which are being incorporated in threat systems. These efforts are complemented by examining the evolutionary trends of US and allied systems and crosspollenizing our ECCM and ECM communities so that lessons learned can be exchanged, recorded, and implemented into our systems.

Because of the ever-changing nature of the threat, our R&D efforts must result in systems that are versatile and adaptable. Software-controlled modularized systems that can be built upon allow us to change our systems as the threat changes. Modularized systems also allow us to incorporate contingency modules in existing systems to respond to a changed threat.

The major outcome of such R&D efforts is the development of systems that are not only effective against known threats but have generic capability against families of threats. While the dynamic and multi-faceted character of a predictive vice reactive approach to R&D could give the impression that the Navy was spending too much on R&D and not fielding many systems, without this approach, we would only field systems to counter a decade-old threat.

As I have tried to illustrate, it is our knowledge of the threat that underlies our Maritime Strategy. Fortunately, this knowledge also gives us the information on which to base R&D efforts that correspond to the threat and, therefore, support our Maritime Strategy.

MOBILIZING AMERICA'S INDUSTRIAL CAPABILITY

Over the past year, the Navy has made important headway in two programs involving this country's industrial capability. These programs are the Wartime Surge Study on which we have important results to report, and the Rapid Acquisition of Manufactured Parts (RAMP) program -- which is equally impressive.

WARTIME PRODUCTION SURGE

The Navy, like the other services, is faced with the problem of the need, if war threatens, for a high number of expendable ordnance. We must have a realistic plan to mobilize our industrial capability to surge and produce those expendables in large quantities and quickly. Until recently such planning was based upon stereotyped studies without motivated, innovative dialogue between industry and the service. Using this new dialogue approach the Navy has sponsored three studies on the MK-46 torpedo, the AIM-9M Sidewinder, and the Sparrow missile. We have dramatic results to report on the MK-46 torpedo and the AIM-9M Sidewinder. The Sparrow study is underway.

The Navy felt that industrial prime contractors and their major subcontractors did not have an adequate appreciation of the environment likely to accompany a war threat. We often forget that there are few left in the workforce or in the service who remember the stunning civilian and military mobilization efforts of 1941 and 1950. Therein lies a key factor -- some education is required to convince our industrial colleagues that in an environment which threatens our society there will be no priority for production of creature comfort consumer items. Once this scenario was understood, I am proud to say we found that our production engineers were as creative and innovative as their grandparents were -- in some cases more so.

The study team asked the producers of the MK-46 two questions: how much investment would be needed in peacetime to increase torpedo production ten-fold in wartime and how quickly could the contractor reach wartime production goals?

Initially, Honeywell, the prime contractor for the MK-46, had estimated that a $22.3 million peacetime investment was needed, mainly for additional production and test equipment. This figure was lowered to $6.9 million when the contractor acknowledged that if certain testing procedures were relaxed, such as those to ensure long shelf life, cosmetic standards and double-checks, then the additional test equipment was not critical.

Where previous estimates required 24 months to increase production tenfold we arrived at a contractor-Navy consensus that we could increase production of the MK-46 from 80 to 800 units in two to three months.

Why is there such a difference in the estimates? Using current peacetime procedures, it would take 24 months to expand. In wartime, the plants would be operated around the clock, the labor force would be shifted from commercial products, and a specification which reduces the 20 year shelf life would be imposed. At Honeywell, these production workers require only two weeks of retraining. Also, as production expands, efficiencies can be realized. Now, many machines stand idle as workers move from one machine to another. In wartime, each station would be manned and work could proceed continuously.

Honeywell's subcontractors showed similar gains once the mobilization environment was defined. They can divert labor from commercial production and can train labor quickly.

For AIM-9M Sidewinder, the wartime production goal is three times current production. Previous mobilization studies had shown 18 months lead time and an investment of 23 million dollars would be required to meet our wartime goal. Our studies showed these time and resources estimates overly conservative and when we applied the MK-46 study principles to Sidewinder, production ramp up time fell dramatically to five months. Further analysis allowed us to lower our lead time to four months. We believe the investment required to meet these lead times is more in the range of 18 million dollars and studies continue to refine this figure.

The third study on Sparrow had just begun. The Navy is examining the Sparrow AIM/RIM-7M Guidance and Control Section (GCS). Raytheon is the prime contractor. The Navy would like to increase production by almost fourfold during war. We believe we can do it.

I believe you will agree these are startling and gratifying results. I have hence learned some valuable lessons:

- we need a wartime production specification for these expendables which is based upon much less shelf life and much less in-process testing;
- we need in place legislation which relaxes specific regulations during a national emergency;

- most firms now producing expendables can expand assembly capabilities at modest cost; and

- our industrial engineers are creative and innovative on surge once they understand the problem.

There are also some lessons which require some further study and thought. For example, the electronics assembly for the MK-46 torpedo is done off-shore due to cheaper labor costs. Production surge planning will require us to stockpile a large number of these assemblies or fund a reinstatement of this production capability. We have found in all three studies that the electronics industry is our weakest link in the mobilization environment as that industry must go offshore on labor intense assembly to keep costs down.

But the Navy is doing more than studying these issues. We cannot wait for the immediate threat of war to verify our studies. This year we will produce torpedoes using modified procedures. The goal is to see how well these torpedoes perform when some process and specification tests are waived. In addition, the Navy has put money into the FY 1987 budget to cut the time it takes to expand in wartime. The Navy has $18 million planned for Sidewinder surge, $11 million for Harpoon, and $23 million for sonobuoys. The Navy will continue to examine ways to increase wartime surge capabilities. Our knowledge of the mobilization environment has advanced considerably in the last year, and we expect it to advance even more in the coming year.

RAPID ACQUISITION OF MANUFACTURED PARTS (RAMP) PROGRAM

A major factor in maintaining and repairing the ever increasing variety of systems and equipment used by us is the availability and timely acquisition of parts. This is a serious problem, particularly for parts that are no longer being manufactured, for which no specifications exist, and that are only needed in limited quantities. One of our recently initiated projects addresses this issue. It features a team of industrial firms working closely with universities, other Federal agencies, and Department of Navy organizations under the coordination of a State organization. We call it RAMP -- the Rapid Acquisition of Manufactured Parts program.

RAMP's objectives are to: (a) integrate advanced computer integrated manufacturing into the Navy logistics system; (b) to establish procedures and a capability to communicate our parts requirements and specifications to automated or flexible manufacturing facilities; and (c) to install prototype flexible manufacturing units in Navy industrial activities. RAMP will shorten the time required to obtain parts -- we expect reductions down to as little as one-fifth of the time currently required for some parts. This will in turn reduce our inventory investment cost. Technologically speaking, it will improve manufacturing techniques and in-process quality control. The focus is initially on small mechanical parts and will include printed wiring assemblies or circuit boards in the near future.

RAMP is being carried out by a consortium of industrial, academic and government organizations, organized by the South Carolina Research Authority. Funding is on a cost sharing basis with the Consortium picking up about a third of the $90M costs projected over five years.

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R&D PROGRAMS IN THE NAVY MISSION AREAS

Now let me discuss our mission areas. We have found that systems dedicated to a single mission are increasingly unaffordable. Therefore, we are developing systems that are dual role or even multimission. We are also trying to find innovative ways to apply technology developed for one mission area to other areas and weapon systems.

In cases where a weapon system performs missions in more than one area, it will be discussed in its primary mission area. I will discuss programs in the following mission areas: electronic warfare, strategic programs, anti-submarine/mine warfare, anti-surface/strike warfare, anti-air warfare and amphibious operations. In each program I cover, I will show some of the ways we have responded to your scrutiny of our programs with better ways of doing the Navy's business.

ELECTRONIC WARFARE

The Navy's goal in Electronic Warfare (EW), is to deceive, deny, disrupt and exploit the enemy's electronic emissions. The threat that the Navy has to counter has proliferated across the entire electromagnetic spectrum from low-frequency surveillance radars through radio-frequency guided missiles, infrared homing missiles, optical, and laser-directed threats and beyond. These threats are integrated through an external command and control network. To counter this threat, the Navy strategy for EW addresses all phases of an engagement providing both offensive and defensive capability to the fleet.

In the surveillance phase, systems under development such as the Battle Group Passive Horizon Extension System (BGPHES) will provide increased surveillance capabilities.

Through information provided by BGPHES, EP-3E updates in the future, RPV's and other assets, we can use our newly developed devices which will result in depletion of threat assets, delayed action and confusion which could potentially cause an adversary to reconsider the advisability of a hostile action.

When an engagement has proceeded into a targeting phase, active support EW systems such as the recently deployed EA-6B ICAP II and the improved and increased number of SLQ-32's will provide target screening and false targets which will delay hostile weapons systems' targeting solutions until the hostile platform is within our weapons range or potentially cause the expenditure of weapons on false targets. On the offensive side, the ongoing effort to marry the offensive capability of the HARM missile system with the electronic warfare capability of the EA-6B aircraft will provide a capability to selectively target desired high-value targets. BGPHES and other assets will provide extended targeting information which when integrated into the offensive capability of the Battle Group will provide an extended range for the intelligent uses of weapons.

In the terminal phase, our self-protective EW suites such as the recently deployed ALR-67/ALQ-126B on the F/A-18, the SLQ-32, the ALQ-162 missile jamming system (which was just approved for production), and our family of air-launched and ship-launched infrared and radio-frequency decoys should improve survivability and increase the warfighting capability of our tactical assets. In general, the Navy is developing its EW suites in an integrated package consisting of warning receivers, active onboard jammers and offboard decoys instead of independent systems. These suites are complemented by dedicated EW support systems like the EA-6B and BGPHES. This approach provides complementary operation of systems by design vice complex after-the-fact tradeoffs to permit simultaneous operations.

The keynote of Navy's terminal phase EW strategy is commonality. The Navy is developing its electronic warfare capability with an emphasis on eliminating any efforts which are redundant with the US Army or Air Force. To this end, we are examining all our EW programs and requirements while conferring with the other Services to structure a total EW program which is nonduplicative, affordable and interoperable. Our recent cancelling of Navy JTIDS and the restructuring of the program in line with the Air Force JTIDS is an example of our commitment to commonality.

The initiatives of the 1985 DOD EW Plan are being used as a departure vehicle for these joint efforts. It is Navy policy that EW systems for small helicopters be developed by the US Army and be procured as additions to Army requirements. This effort results in almost total commonality between USMC and US Army small helicopters. Jointly with the Air Force we are concluding the Full-Scale Development for the ALQ-165 system and are beginning development of the Integrated EW System (INEWS) for the nextgeneration advanced technology aircraft. In radar-warning receivers for tactical aircraft, we are providing Navy inputs to the Air Force ALR-74/ ALR-56M program in order to achieve commonality in future upgrade programs where cost effective for both Services.

In addition to our joint effort with other Services, we are actively pursuing joint decoy developments with countries like Australia, the United Kingdom and others to reduce our research and development costs and to ensure commonality with our allies. In the effort we are pursuing with Australia we are breaking new ground. This is a truly cooperative R&D effort. We plan to develop the electronics payload and the Australians will develop the flight vehicle. We will jointly integrate these two components of the system.

In order to coordinate our EW assets, we are developing systems like the EW Coordination Module (EWCM) and the EW Control System (EWCS) which provide Battle Group and platform integration of the EW assets, reducing duplication of responses and aiding in the evaluation of the effectiveness of EW actions.

In addition, we are developing improved ranges and simulators to provide realistic mixed force threat scenarios so that an operator can exercise not only in a dense threat environment but in one which contains representative jamming of his sensors. This training is mandatory to allow the operators to develop tactics which optimize offensive capability in a hostile jamming environment and increase awareness of the defensive advantage provided by our own coordinated EW systems.

The Navy EW acquistion policy is one of cost control and competition. We have restructured ongoing production programs such as the SLQ-32 and the ALR-67 to bring on a second vendor to reduce cost. The next version of the EA-6B, called Advanced Capability (ADVCAP) is being developed under a capped R&D contract which contains three years of production options. In the Active Electronic Buoy (AEB), we are competing at the limited production phase and we will maintain competition in all later production phases.

STRATEGIC PROGRAMS

This past year was the twenty-fifth anniversary of our Fleet Ballistic Missile (FBM) force. During this period the FBM force has been on 2,379 deterrent patrols. To meet the changing threat the force has been progressively modernized from Polaris to Poseidon to TRIDENT I.

TRIDENT

The Navy has accepted seven TRIDENT SSBN's, five of which are operational conducting deterrent patrols carrying the TRIDENT I Missile. There are thirty Poseidon SSBN's, twelve of which carry the TRIDENT I Missile.

In the last few years the Soviets have increasingly hardened installations which protect their leadership and warfighting installations. To counter an ever increasingly hardened target requires weapon accuracy as well as an adequate explosive force. To achieve the appropriate balance between these two parameters we initiated an accuracy improvement program in the mid-seventies. This program looked at all of the parameters which add to system inaccuracy and needed improvement if a mobile system was ever going to be able to engage targets that had been hardened. The results of this study were the basis for the TRIDENT II program which now has entered into the third year of engineering development. The TRIDENT II program has the accuracy and yield to engage this broad spectrum of targets.

Because of the increased explosive arc of the TRIDENT II rocket motor, we had to build a new launch complex at the Eastern Test Range. The work on this complex has progressed very well and is on schedule for the first launch in 1987. The facility at Kings Bay is also progressing very well to support the IOC.

There has been a substantial activity on subsystem tests during the past year. These tests include all three stages of the rocket motor, the launcher, the navigation and guidance systems and many others. I cannot say that all tests were successful on the first try but, on balance, I would say we are doing all right and are on schedule. One item that is of concern, and over which we do not have control, is the continuing slippage of the availability of the Global Positioning System receivers. In order to meet our testing requirements and the initial deployment we have had to come up with a work around interim solution.

As we reported previously, the first TRIDENT II weapon system will go onto the ninth TRIDENT submarine. The introduction of the TRIDENT II weapon system onto the ninth TRIDENT submarine has been and remains a challenge since she was to be a TRIDENT I ship and construction had begun before the start of the TRIDENT II program. I am happy to say that to date we have met all of the scheduled weapon system component deliveries as well as all relevant interface design information requirements.

Strategic Communications

The maintenance of connectivity with our SSBN force has been absolutely essential to the success of the strategic forces. One significant improvement in this area has been the completion of the Extremely Low Frequency (ELF) transmission system in Wisconsin. The first phase of the ELF system is currently undergoing operational testing and is expected to become operational in late FY 1986. A second transmitting site, which will complete the ELF system, is being constructed in Michigan and is expected to complete operational testing in the fall of 1987.

The planned replacement for the EC 130 TACAMO airframe, the E6A, is progressing well. Fabrication of the prototype aircraft commenced in FY 1985. Procurement authority of the first two production aircraft will start in FY 1986. The communications suite will come from the EC 130 TACAMO aircraft. A fleet of 15 E6A's is planned.

TOMAHAWK

To both increase our deterrence and our conventional strike capability we have now deployed the TOMAHAWK weapon system on eight surface ships and fourteen submarines. This year was the first year of competitive procurement of TOMAHAWK. During the past year we have also completed the Operational Evaluation and authorized production of the conventional variant of the TOMAHAWK system. The submunition dispenser variant is currently undergoing developmental testing and will enter OPEVAL in FY 1987.

Based on a successful TECHEVAL and to meet the requirements for the OPEVAL and eventual deployment on the first two 688 Class submarines with the Vertical Launching System, limited production of the launchers has begun. Vertical launch deployment tests have been performed from our underwater ship simulator for submarine launch tests and from the USS NORTON SOUND for surface ship launch tests.

The two major efforts which we are currently pursuing are to improve the shipboard weapon system software to reduce the eventual maintenance cost and to reduce the time required to plan a mission of this missile.

Strategic Defense Initiative (SDI)

The Navy fully supports the President's Strategic Defense Initiative. We are providing support, through our laboratories, in basic technology research. The majority of the Navy work has been in support of directed energy technology, the largest single effort being an outgrowth of the Navy's High Energy Laser (HEL) Program. This joint service effort under Navy program management uses the most powerful research laser in the free world. The program is in the forefront of solving a wide range of generic technical problems relevant to HEL systems, and is particularly important to the development of the optical train and beam director portions of the SDI Office's Free Electronic Laser Program.

The Navy is also making important contributions in the area of SDI Battle-Management(BM)/C^3. Our contributions to SDI's BM/C^3 research is a natural extension of Navy research in this area for multi-layered defenses of carrier battle groups.

ANTI-SUBMARINE/MINE WARFARE

The ASW and Mine Warfare R&D programs directly support the basic ASW warfighting strategy which remains unchanged. We continue to rely on a layered offensive strategy designed to maximize enemy submarine attrition and assure a high level of protection for our strike and reenforcement/resupply forces. The first layer is forward area and barrier long-term offensive operations involving SSN, VP and long-range or area surveillance systems. Subsequent layers form defensive screens around naval task forces, employing SSNs, surface ship advanced ASW systems, helicopters and carrier-based fixedwing aircraft.

The attack submarine has for many years been preeminent in the Soviet fleet force structure. The larger size of the Soviet submarine force has long been a problem that we have effectively countered by application of superior technologies.

During FY 1985 we formulated a Master ASW R&D Strategy and identified key technology areas for maintaining our ASW advantage. The investment strategy for translating these technologies into our ASW systems is being developed and operational requirements are being documented. The high payoff technology areas which can be readily implemented in the near term have been given special focus as Urgent ASW Initiatives. This ASW thrust is reflected throughout the budget in such areas as low frequency active surveillance system development, broadband acoustic data processing, active sonar classification, and efforts where technology development strategies are being prepared.

We are also emphasizing commonality initiatives in the ASW mission area such as the Enhanced Modular Signal Processor (EMSP) program which continues to progress on schedule. It completed a Preliminary Design Review and System Level Level Critical Design Review in FY 1985. It has a breadboard system in operation and will commence fabrication of the Engineering Development Models this fiscal year. We are pursuing a VHSIC technology insertion program for the arithmetic processor which will be included in the production EMSP's. The EMSP will be used in a wide range of ASW systems, including the P-3 Update IV, FY89 Submarine Combat System, SURTASS Upgrade, Fixed Distribution System, SQQ-89 Upgrade, and the CV helicopter Advanced Lightweight Sonar System.

ASW Surveillance Systems

The Phase II Sound Surveillance System (SOSUS) backfit program has been completed, and we are preparing to implement improvements, such as inter-array processing, adaptive beamforming, integrated acoustic displays, and wide-band acoustic recall.

The first Surveillance Towed Array Sensor System (SURTASS) ship was deployed in FY 1985, and there are now 7 ships operational, all of which are achieving outstanding results. We are now attempting to accelerate development of the Small Waterplane Area Twin Hull (SWATH) platform for the SURTASS mission, and intend to award a contract in FY 1987 to upgrade the SURTASS system. Technology advancements in low cost, low power, small diameter fiber optic cables that can efficiently transmit data at very high rates, combined with our ability to process and manage increasingly greater quantities of data with high speed computers and computer assisted operator aids, are making this approach a more effective method.

We have deployed a test bed for evaluating the Fixed Distributed System concept and are achieving exceptional results. In FY 1986, its capability is being expanded and if the results continue their encouraging trend, a Milestone II decision will be made in FY 1988.

In the ARIADNE program, we have demonstrated the technologies required to deploy a self-powered fiber-optic system from fixed-wing aircraft, helicopters and surface ships. We are now preparing for an advanced technology demonstration which is scheduled to culminate in a large-scale system evaluation in FY 1989.

Attack Submarine Programs

SUBACS Let me begin by discussing the Submarine Advanced Combat System (SUBACS). This system was to be incorporated in the present SSN-688 Class submarines, but its technology was also to be used for the SSN-21 combat suite, which we have designated the FY89 Submarine Combat System.

SUBACS Basic was necessary to give SSN 688 Class submarines the capability to meet the growing Soviet threat. SUBACS adds a robust system and increased passive sonar performance against Soviet submarines. Space and weight savings of SUBACS allow SSN 751 and follow-on ships added buoyancy. Without the capabilities added by SUBACS Basic, our SSNs would not be able to meet the improving enemy threat.

The SUBACS program encountered significant technical problems with fiber-optics data bus performance and with ceramic circuit-board manufacturing processes A combination of previously unfunded requirements, cost overruns in the Full-Scale Engineering and Development contract, and increased production cost of certain components resulted in a financially unexecutable program with excessive schedule risk.

In view of these problems, we carefully evaluated the potential impacts of either program cancellation or stretchout. Cancellation was considered as an option which might be necessitated by continued inability of the prime contractor to control costs or by Congressional withdrawal of necessary funding support. Stretchout was considered primarily to provide additional development time if it became apparent that adequate capability could not be provided in time to support ship delivery schedules; revision of ship delivery dates would also have been required. The costs, both in dollars and in delayed warfighting capabilities, would have been very large for either of these options. Fortunately, continued Congressional support and successful contract renegotiation allowed us to avoid being forced to choose either option.

CHART #3

This chart provides an appreciation for the impact which delay or cancellation of SUBACS would have had on our 688 Class attack submarine shipbuilding program. We currently have nine SUBACS-equipped ships under fixed-price contracts with Fiscal Year 1983 through 1985 funds. Those ships are scheduled to deliver at an average interval of approximately three months. We concluded that each $10 million of FY-1986 funding not provided would delay equipment delivery to the shipbuilder by one month, with an equal delay in the SSN 751 delivery date. Because of shipyard workload and scheduling considerations, delays greater than two months would necessarily delay the following ship and a ripple effect would probably occur deeper in the schedule. Cancellation of the program would have delayed SSN 751 for at least a year for procurement of an alternative system and necessary major rework of associated shipboard systems and structures. The ripple effect from that delay would have been extremely costly to both the shipbuilders and the government, and we would undoubtedly have found ourselves responding to claims for damages.

The program has now been restructured into two separate programs -- The AN/BSY-1 and the FY89 Submarine Combat System.

AN/BSY-1 The AN/BSY-1 is the combat system intended for FY 1983-1988 SSN 688 Class submarines. The fiber-optic bus has been replaced with low risk Navy standard UYK-43 computers for interconnection of functions. Substantial use is being made of existing software and software currently being developed by other programs. The significant warfighting improvements expected from the original SUBACS Basic system have all been maintained. The contract has been renegotiated to impose cost ceilings and penalties for performance and schedule shortfalls as directed by the Congress. Competition has been enhanced by bringing aboard a follower contractor. As presently structured, we now have an executable program that will meet the shipbuilding schedule.

FY 89 Submarine Combat System The FY89 Submarine Combat System replaces the former "SUBACS B" (the ultimate SUBACS configuration) for SSN-21. We are also evaluating an option to put it on the FY 1989 SSN 688 Class submarines. In the FY89 Submarine Combat System, competition has been greatly increased by contracting for parallel two-year System Design Definition efforts. The principal emphasis will be on improved performance and operability enhancement achieved through software development. These initiatives have generated great interest within the business community. It is clear that the Navy will benefit from competition and innovation. We are confident that we will meet or exceed all requirements previously imposed on "SUBACS B".

SSN-21 The SSN-21 preliminary design effort has been completed. Competitive contract design efforts are presently in progress at both submarine shipyards, due for completion this summer. The preliminary design effort accomplished a number of things. Technical risk has been reduced through analysis of design tradeoffs, cost estimates have been validated, and the bow arrangement has been revised, yielding greatly improved sonar capabilities.

The bow design is now compatible with the Advanced Conformal Submarine Acoustic Sensor (ACSAS) concept, and improved quieting has been achieved through design considerations.

The technology now being applied to the design of SSN 21 is available only because of earlier foresight in committing resources to basic research and advanced development in undersea warfare programs. As SSN 21 transitions from the drawing board to Fleet operations, it is vital that we continue to focus on future systems which will continue our qualitative advantage over the Soviet submarine force. We also recognize the need to continue refinement of basic hull, mechanical and electrical systems technology to provide greater power, higher tactical speed, enhanced quieting and increased performance/displacement ratios.

SEA LANCE To further enhance our submarine capabilities, we plan to enter Full Scale Engineering Development of Sea Lance (ASW/SOW) this year. The Secretary of the Navy is personally committed to achieving IOC as early as is feasible. This is a very important program in that it will provide our submarines with a much needed standoff attack and reattack capability against the improving Soviet threat. Progress of development and validation and initial initial technical testing have been highly encouraging with respect to achieving performance goals within cost and schedule.

Airborne Anti-Submarine Programs

A Milestone I decision for the next upgrade to the Maritime Patrol Aircraft Aircraft, the P-3 Update IV, was approved in FY 1985. This upgrade will include a distributed data-bus architecture for the mission avionics, installation of the Enhanced Modular Signal Processor, new displays and integration of a new nonacoustic suite. Two contracts for a contractor demonstration phase were awarded earlier this year which will lead to a Full Scale Engineering Development decision in FY 1987. We are presently structuring a program to install new, more fuel efficient engines on the P-3 airframe to increase its range and endurance and intend to compete procurement of the P-3 Update IV (avionics, airframe and engines) in FY 1990-1991.

Another airborne ASW platform is the SH-60B LAMPS MK-III which successfully completed its first deployment in FY 1985. It has added a new dimension to our FFG-7's and the battle group ASW middle zone defenses. The SH-60B LAMPS III significantly increases the ASW capability of surface ships compared to the SH-2F LAMPS MK I. Also, a low cost solution to the replacement of the aging SH-3H carrier-based ASW helicopter is provided by the SH-60F, a variant to the SH-60B LAMPS MK III. A fixed-price development contract has been awarded for the carrier-based SH-60F helicopter with Navy technical testing scheduled for FY-1987.

Approval for limited production has just been granted for the S-3 Weapon System Improvement Program which is designed to upgrade the S-3's acoustic and nonacoustic capabilities. Fleet installations of this upgrade are scheduled to begin in FY 1988.

Surface Ship ASW

We have made strides in surface ASW programs in the last year. The Tactical Towed-Array Sonar (TACTAS) AN/SQR-19 is now entering production and will be installed on our cruisers and destroyers, as well as the active force FFG-7's. This system will complement the LAMPS MK-III system. Both the SQR-19 and the earlier SQR-18 are being upgraded in response to changes in the Soviet submarine threat.

The AN/SQS-53C Advanced Surface Ship Sonar successfully completed Milestone IIIA. Approval has been granted to build the AN/SQS-53C sonar for the DDG-51 and to procure long-lead material for three additional systems.

We have completed the Development Options Paper for the AN/SQS-89 ASW Combat System Improvement Program. The subsequently established Operational Requirement will guide the selection of a specific option.

Mine Warfare

The Navy is continuing an ambitious program which will ensure our ability to counter the evolving Soviet mine warfare threat well into the next century.

Using the additional funding provided by Congress, we have completed a study to determine the types of advanced mines required through the turn of the century. The two major recommendations of the study to be implemented are to improve the stockpile of mines to keep them abreast of the threat in shallow and deep water and to develop a new mine for medium water depths. We are also currently engaged in discussion with our allies on how to best proceed with a cooperative development program with our New Generation Mine.

The Navy's mine countermeasures program is directed primarily toward providing our MCM-1 and MSH-1 Class ships, and MH-53E helicopters, with state-of-the-art minesweeping, minehunting, and mine neutralization equipment. New sonars, remotely operated mine sweeping vehicles, and improved navigation and command and control systems head the list of systems in development to enable us to clear U.S. ports and selected overseas areas in support of our Allies, as well as to enable us to rapidly respond to worldwide contingencies such as the recent Red Sea mining incident.

STRIKE AND ANTI-SURFACE WARFARE

We are making the very best use of our new acquisition strategies to develop and rapidly field the weapon systems needed to reach out and take the offensive, when and if necessary, against heavily defended land and sea targets. The quality and quantity of those defensive systems is driving us to develop standoff targeting sensors, precision standoff weapons and unmanned vehicles to greatly reduce costly platform attrition: costly in terms of precious hardware replacement and irreplacable in terms of our aircrews.

We believe our acquisition policies will help us to rapidly develop affordable non-goldplated systems; affordable not just from the size of the RDT&E bill, but also in terms of the historically elusive production and support costs. We are using more off-the-shelf technology and common subsystems in our specifications to allow for fixed priced development contracts and up front agreement on not-to-exceed production costs. We are using the best cost control tools possible, competition and requirements discipline, to gain the best price for the taxpayers' hard earned money. With continued Congressional and Navy support we expect industry to make the same investments and take the same risks that are made in the commercial market place.

Some of our major Strike and ASUW systems which need your continued support include: the A-6F Upgrade to the A-6E; the night attack systems for the F/A-18 and AV-8B, which will also be integrated into the A-6F; the tri-service Unmanned Air Vehicle Program; the SH-60B Penquin missile integration program; the HARM weapon system; the EA-6B Advanced Capability program and integration of the HARM missile; the TOMAHAWK weapon system and the Advanced Tactical Aircraft.

We have initiated the development of an Advanced Tactical Aircraft (ATA) with greatly enhanced survivability against the evolving threats and the ability to make our present and near term inventory of weapons more effective. The ATA system design will be robust against future threat growths and have the flexibility to accept new technologies and complement other missions. This program employs the acquisition strategies addressed earlier with competition built in from the start. We are capitalizing on developed and proven US technologies from other programs, and aggressively seeking commonality of technologies and subsystems between the ATA and USAF ATF.

I would like to add that your support and confidence in the F/A-18 program is really paying off. From its most recent deployments, the F/A-18 received nothing but praise from the fleet. Its maintenance hours per flight hour rate is the lowest rate for any tactical aircraft and continues to decrease. Its mean time between failure rate remains high. Quoting from a Battle Group Commander's post deployment report, "The bottom line is the F/A-18 is a winner that adds increased flexibility and offensive punch to the battle group. We like it." The integration of the night attack system will further extend the operational utility and flexibility of the F/A-18.

In addition to the F/A-18's fleet performance, we are extremely pleased with the HARM weapon system. The unit cost of HARM has decreased dramatically since its first production. From FY 1982 to FY 1986 the unit recurring flyaway cost has decreased from $589K to $266K, a 55% decrease.

As requested by the FY 1986 Conference Report, last fall Secretary Lehman and Secretary Orr certified for the Services that the HARM program meets its specification, is being constructed to the current data package, and will engage the intended threat. The FY 1986 Conference Report expressed concern that HARM containing the FY 1982/FY 1983 software was not performing or being produced as specified. This apparently stemmed from test results of F/A-18 firings which produced three successes of eight shots. These results continued to highlight known OPEVAL deficiencies including specific F/A-18 air flow field launch irregularities in the supersonic mode.

A configuration audit of the HARM missile was conducted by an independent government team lead by the Naval Avionics Center (NAC) beginning on 9 May 1985 and completing on 21 July 1985. The team was composed of 62 production and technical experts. The overall findings were:

- There have been no hardware or software changes that would degrade the overall missile performance.

- Analysis of all flight test results indicates that no performance degradation of the HARM missile has occurred since the operational evaluation baseline.

I am happy to report that since my testimony last year, HARM has achieved a high success rate. A majority of these shots were with missiles that incorporated the major software upgrade (FY 1984 software) which was designed to correct the problems identified in previous tests. These successful shots with the FY 1984 software included one shot in F/A-18 supersonic launch mode.

HARM is also receiving rave reviews from the fleet. Our pilots are finding new ways to use its versatile capability and its reliability has been phenomenal for such a complex system. We are so pleased with HARM that we are accelerating its integration into the EA-6B. In a step toward NATO commonality and interoperability, the Government of West Germany signed a contract in December to equip its F-4 and Toronado aircraft with HARM. We are continuing the development of the HARM Low Cost Seeker (LCS) and the progress to date is encouraging. Both contractors, Ford and Raytheon, are fully onboard and we are optimistic about their ability to meet Secretary Lehman's commitment. In fact, we are studying the possibility of accelerating the LCS schedule.

We are also looking at applying the technology in other areas where we have stong operational requirements. As an example, under the ERASE Program, we are looking at a self defense reactive ARM for our fixed wing aircraft.

We are updating our comprehensive Anti-Radiation Weapons Roadmap with the other services, and have tied it in with our Strike/ASUW Master Plan. We are looking at a broad spectrum of weapons including HARM, the Dual Role ARM concept, low cost saturation weapons and other special programs. In this way we look at the biggest picture possible to ensure we minimize the number of weapons involved and come up with the most cost effective solution to common Service requirements.

ANTI-AIR WARFARE

Let me now build on discussions that I had with you last year on programs in the Anti-Air Warfare area.

Airborne AAW

Our AAW strategy requires the destruction of enemy threat platforms and airborne weapons whether launched from air, surface, submarine or land.

The growing capability of the enemy has driven a series of improvements to the E-2C since its introduction in 1971. With the E-2C programmed to be aboard our carrier well into the twenty-first century, we are driven to continue to upgrade the E-2C to keep it abreast of the threat. Two block upgrades are planned for the E-2C. Group I will increase the automation of the system by incorporating a high speed data processor that will increase surface ship detection, increase the number of targets that are currently handled and provide improvements for electronic counter-counter measures. Concurrent with the introduction of Group I is the incorporation of an engine upgrade to improve single engine performance at low altitude on hot days. Group II will further increase the radar performance.

The F-14A is our primary fighter in the outer air battle. As with the E-2C, the growing threat has forced us to update the F-14. To accomplish this in an economical fashion and achieve a high degree of commonality among our major tactical aircraft, the Navy embarked on the F-14D and A-6F projects in which both programs share over eighty percent subsystems and software commonality. These subsystems will also have maximum commonality with F/A-18 a system that will be effective well into the twenty-first century. Competition has kept the price down; firm management has kept us out of redundant programs; commonality has permitted us to add more capability to our force in a shorter time and at less cost. We have signed a contract with Grumman for a fixed price F-14D development program and three years of procurement under firm not-to-exceed options.

An important element of anti-air warfare is of course the air-to-air missile. In this area I think the Navy has an excellent track record in providing systems with outstanding capabilities such as SIDEWINDER, SPARROW and PHOENIX. As the threat grows in capabilities and our technology is compromised, we must continue to pursue upgrades to these basic missiles that will make up the major portion of the inventory through this century. These upgrades of current systems are the ASRAAM which is being developed by NATO as a follow-up to SIDEWINDER; the AMRAAM being developed by the the USAF as a follow-on to SPARROW; and the AAAM being studied by the Navy as a possible follow-on to

PHOENIX. SPARROW (in the surface-launched version) and SIDEWINDER are NATO consortium and Japanese coproduction programs.

Each of our missile programs will be developed and procured under policies established by the Navy for competition at all levels, firm fixed-price contracts, and commonality where it makes sense.

Shipborne AAW

Last year in my remarks to you, I discussed improvements we were pursuing in offensive standoff capability, battle group air defense against anti-ship missiles, reduced weapon reaction time, and improved ability to put weapons on a target in a timely and accurate manner.

We have also been working on ways to create a synergistic relationship among our systems and ships. We have demonstrated the feasibility of one such concept that improves individual system performance through interoperability at no increase in cost.

In this demonstration, we successfully engaged targets with standard missiles using search data from an AEGIS cruiser. Engaging the SPY-1 radar target of the AEGIS cruiser with weapons from other ships of the force allows us to defeat our enemy and capitalize on the capabilities of the New Threat Upgrade (NTU) combat system.

Another system that will provide a high leverage payoff is the Naval Airship. This system is scheduled for an FY 1987 new start. We are examining the Airship primarily as an early warning platform to increase our reaction time against high-speed, low-flying anti-ship cruise missiles. It is another smart, simple solution which can provide cost effective, long endurance, organic airborne early warning and improved battleforce asset management capability to CV Battle Groups, Surface Action Groups, Underway Replenishment Groups, Amphibious Task Forces and convoys. The airship's ability to carry aloft large payloads will enable us to use a large aperture, low frequency radar to detect the threat missiles. The Airship can also act as a force multiplier by improving force coordination in anti-surface, strike, and anti-submarine warfare mission areas. We will examine potential capabilities for the Airship with a view to developing a platform that will provide high leverage in several mission areas, be either manned or unmanned and be affordable in numbers.

Another area I would like to report on is our efforts to broaden the industrial base for both development and production of naval systems.

One example of this, which I mentioned earlier, is the AEGIS combat system, which has been broken out into six major weapon components to permit competitive procurement of each, beginning this fiscal year. By 1990, all of these components will be competitively procured. Additionally, we have recently initiated an effort to compete the shipboard integration and associated production system testing of the AEGIS combat system.

A program we structured for competitive procurement when transitioning from development to full production was the Vertical Launch System (VLS). Initially, VLS production unit costs were budgeted at $30.7M and $32.8M for FY 1985 and FY 1986 respectively. Average competitive procurement unit costs for the launchers purchased in FY 1985 was $17.3M. In the FY 1986 buy, the average competitive cost dropped to $15.6M per launcher, even though fewer launchers were purchased. Based on the FY 1985 and 1986 competitive procurements alone, $288M has been saved based on the original budgeted costs over the two years of procurement.

The 5-inch Rolling Airframe Missile or RAM is a program that we are structuring for competitive procurement starting with the first production buys. Recent instrumented flight test vehicle firings have provided missile flight performance data verifying that proper design parameters have been used to correct missile component design deficiencies, which became evident after experiencing high failure rates in the flight test program. The previously suspended flight test program has been reinitiated. DT/OT firings are planned to be completed early in the first quarter of FY 1987.

The RAM Procurement strategy entails dual production in the United States and Germany. It is planned that the U.S. will build a production line at General Dynamics/Valley Systems Division and the German government will establish a production source within Germany. A leader/follower arrangement for production will be provided utilizing General Dynamics as the leader. Initial limited production is planned for FY 1987, with full competition not later than FY 1989. We hope that we can count on your support for this system, not only because of its implications for U.S. naval forces, but also due to the commonality and interoperability it represents with an important NATO ally.

Industry wide participation was solicited this past year to assist the Navy in helping to determine a realistic set of options for an Outer Air Battle system concept. The structured study phase was designed to capitalize on system/component approaches that industry feels could best counter threats in the late 1990's and early 2000's. We signed six separate contracts with various industry participants to provide their best technical AAW defense approach for the Navy to consider. Contractors were to investigate system approaches for both advanced air-to-air missiles (AAAM) and advanced surface-to-air missiles (ASAM). The contractors were asked to address commonality in their proposals. Ideally, a single missile development should fulfill both the air-to-air and surface-to-air missions. This missile could be launched directly from aircraft and boosted from vertical launchers on surface ships. If the single missile approach does not prove cost effective, common technology applicable to both missile systems should be maximized, i.e., missile guidance signal processing, propulsion, ordnance, etc. A development option paper will be provided for a Navy/DOD determination on how best to proceed with the follow-on AAW system for the year 2000 and beyond. The Milestone I decision will occur in the April/June 1986 time period.

My discussion of initiatives in the area of Anti-Air Warfare clearly demonstrates the benefits of competition early in development and in early phases of production.

AMPHIBIOUS WARFARE

Amphibious warfare remains an integral part of our maritime strategy. We are moving forward with programs in this mission area that will ensure the Navy/Marine Corps team has the operational capabilities needed to execute the strategy in the threat environment of the 1990's.

Two of our highest priority programs, the V-22 OSPREY tilt-rotor aircraft and the Landing Craft Air Cushion (LCAC) will provide a quantum jump in capability to project forces ashore by providing a true over-the-horizon assault capability.

The V-22's speed, range and productivity will revolutionize the way we conduct amphibious assault. This tri-service tilt-rotor aircraft will replace the aging CH-46 assault helicopters in the Marine Corps and will meet the Navy's critical combat search and rescue requirement with the baseline aircraft. Navy planning has commenced this year to develop an ASW variant by the mid-1990's.

The V-22 has completed a highly successful preliminary design phase and is getting ready to transition into full scale development. During preliminary design over 5000 hours of wind tunnel testing have been completed giving the program a sound technical footing and significantly reduced program risk.

The V-22 acquisition strategy maximizes competition. The full-scale development contract is a fixed-price type contract and the production phase will be competed from Lot 1 throughout production. The engine full scale development competition has been completed. A second source will be selected to participate in both the development and production of the engine.

Acceptance testing of the LCAC to date has clearly demonstrated the potential operational effectiveness of this new assault craft, but we have experienced design suitability problems primarily in the area of reliability and maintainability. Fixes for major design deficiencies have been identified and we are aggressively pursuing management initiatives to resolve them. Most significantly, we have brought in a viable second source that will not only drive down the cost but also apply the pressures of competition on the quality of the product.

The need to provide fire support for over-the-horizon assaults has generated new requirements for longer range fire support systems. In response to Congressional direction, we have recently completed a major study of naval fire support requirements in the 1990's. We also have initiated high-payoff projects to increase range and lethality of existing systems such as the saboted subprojectile for the 16-inch gun, as well as examining requirements for single-purpose fire support ships and new systems. Also at your urging, we have taken steps to bring on a second source for the Five-inch Semi-Active Laser Guided Projectile (SALGP). We have initiated a block change to the guidance section that will streamline manufacturing and reduce costs by replacing customized components with off-the-shelf parts. We expect to have full competition by FY 1988.

As you recall, we decided last year to cancel the LVT(X) and defer development of a new assault amphibian until the early 1990's. In the interim, the Marines continue to upgrade the AAV7A1 fleet to enhance its survivability and improve reliability and maintainability.

The Light Armored Vehicle (LAV) program continues to be a resounding success. The Marines have the first LAV battalion operational at Camp LeJeune and the second forming up on the West Coast. We have over 289 of the basic 25mm gun versions on hand and deliveries of three of the other mission role vehicles are beginning. We are ready to commence FSD of air defense and assault gun variants which will round out the LAV family.

We are continuing with the Dragon antitank missile improvement program to provide the Marine Corps an interim capability prior to the Army fielding the Advanced Antitank Weapon System - Medium (AAWS-M). We have structured a competitive program for the development of three product improvements to Dragon. In addition to an enhanced warhead which will improve Dragon's lethality, the Marines will also increase the missile range and speed and combine the day and night trackers into one countermeasure-hardened, reduced weight unit.

CONCLUSION

Let me close with Secretary Lehman's answer to the question of whether we are developing the right Navy and Marine Corps for our strategy. Because research and development projects span decades, and ships take many years to build, the makeup of our fleet and fleet marine forces cannot change radically with each administration. Instead, they evolve over time with policy and technology. The fleet today reflects the wisdom of the deck plates, the labs, and lessons learned from our exercises. The size and design of our ships and weapons reflect the inputs of sailors in contact with Soviet submarines, Kiev-class carriers, and "Bear" aircraft. The wisdom of common sense and the highest available technology are tremendous advantages and these we must bring to the design of today's Navy and Marine Corps.

DEVELOPMENT COST

(FY 84 DOLLARS)

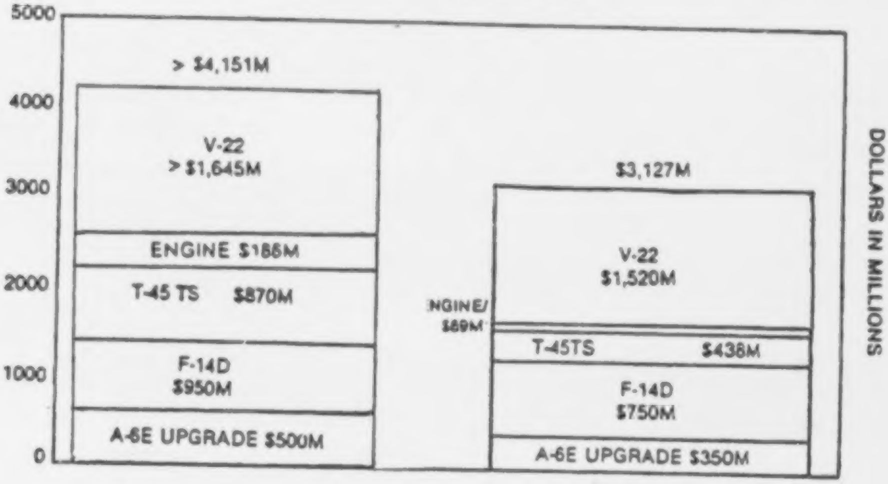


Chart #1

NAVY RDT&E

FY 1987 BUDGET REQUEST =$10,586.8

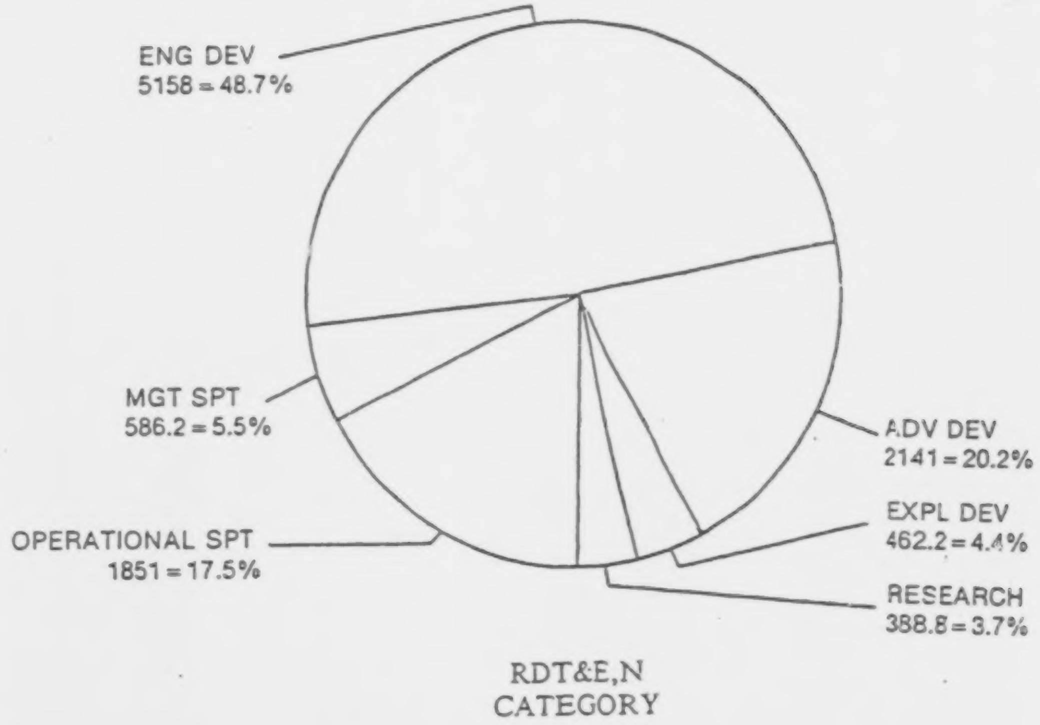


Chart #2

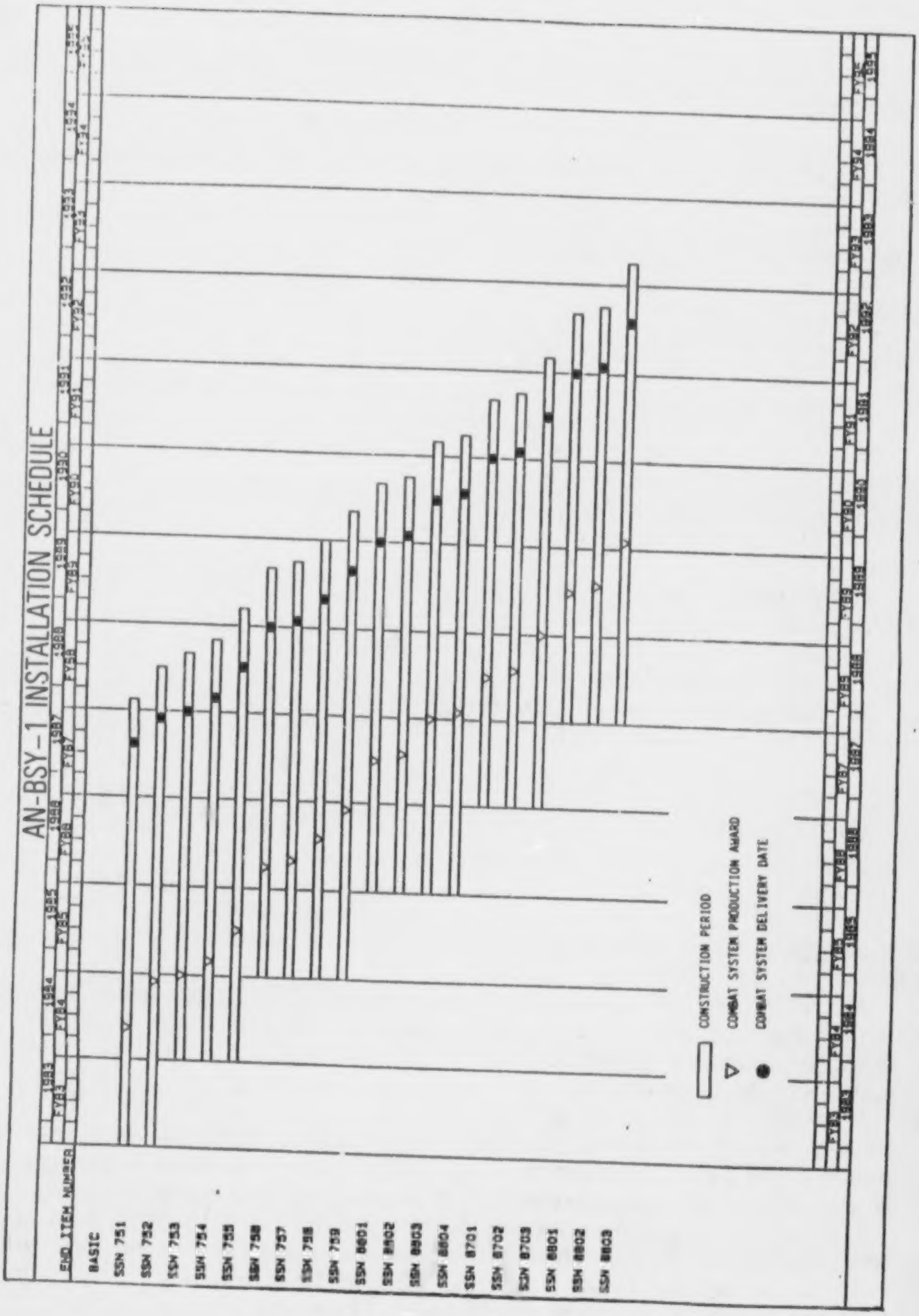

AN-BSY-1 INSTALLATION SCHEDULE
END ITEM NUMBER
FY83 FY84 FY85 FY86 FY87 FY88 FY89 FY90 FY91 FY92 FY93 FY94 FY95
1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995
BASIC
SSN 751
SSN 752
SSN 753
SSN 754
SSN 755
SSN 756
SSN 757
SSN 758
SSN 759
SSN 8801
SSN 8802
SSN 8803
SSN 8804
SSN 8701
SSN 8702
SSN 8703
SSN 8801
SSN 8802
SSN 8803
CONSTRUCTION PERIOD
COMBAT SYSTEM PRODUCTION AWARD
COMBAT SYSTEM DELIVERY DATE

Chart #3

Mr. DICKS. Mr. Chairman, may I ask a question?

Mr. CHAPPELL. Yes.

GRAMM-RUDMAN-HOLLINGS IMPACT

Mr. DICKS. We are faced with the prospect of Gramm-Rudman-Hollings. As I understand it, if we had to implement sequestration in the fall, that there wouldn't be any discretion. You would have to take a cut, 7 or 8 percent, whatever it would be across the board.

Is that your understanding? Have you looked at Gramm-Rudman-Hollings?

Mr. PAISLEY. That is my understanding.

In 1986, we were going to do in 1986 with regard to those cuts. Our position was to preserve all the fixed-price contracts. When we talk about the 1987 budget——

Mr. DICKS. You were able to do that under the provision that existing contracts could be protected?

Mr. PAISLEY. Yes.

Mr. DICKS. So you doubled up in other areas to get your level of cuts out of R&D?

Mr. PAISLEY. Yes.

We took the cuts in areas that were not on fixed-price contracts. You would completely disrupt the whole structure if you started to cut fixed price contracts.

Mr. DICKS. But you can't do that in 1987.

Mr. PAISLEY. That is right.

FIXED PRICE CONTRACTS

Mr. DICKS. I want to get that on the record because I am arguing that we have to develop an alternative budget and that if we don't, there are going to be disastrous consequences. It would be important to put in the record some examples of fixed-price contracts that would have to be broken and what the impact of that would be, if you don't have any flexibility.

Mr. PAISLEY. Let me say something about that in general. There isn't a fixed-price contract that exists where if you break that contract you are not going to have a big problem, and most of them are fairly large contracts.

If we break any of those contracts, it is going to cost us a lot of money. It is no different than the simple example of building your house fixed price. You screw it up every time you make a change. If we have to cut these programs, it is going to be a mess.

I would like to see some legislation put forward to protect as a top priority fixed-price contracts. This committee might be able to help us by saying those programs should be protected. It is only sensible business practice to do that. They are high-priority programs. They are lower-risk programs, because that is how we were able to have contractors sign these contracts. We spent a lot of money to get them into this posture.

[Additional information follows:]

The Navy has detailed data on the cost avoidance effect of Firm Fixed Price (FFP) contracts. The following table the benefits of FFP contracts in seven Navy programs.

[In millions of dollars]

Program	Fiscal year 1984	
	Initial cost estimate	FFP contract
A-6F		
F-14D	$500	$350
T-45TS	950	750
V-22 engine	870	438
V-22	185	89
CG-47	1,645	1,520
Vertical launch system	1,200	900
	288	199

Reduced funding on FFP contracts would have significant adverse effects. For example:

If funding reductions cause the government to partially terminate FFP contracts for the "convenience" of the government, considerable descoping would have to be effected in the statement of work causing schedule delays and the resultant accomplishment of contract tasks at higher rates. In general, any reopening of negotiations of FFP contracts would cause considerable price increases, particularly if acquisition quantities are reduced.

If budget reductions involve the termination of FFP contracts, the government would be liable for termination charges. In the case of multiyear contracts that would have to be renegotiated, the government would be liable for up to the entire amount of the cancellation ceiling in the contract.

Another effect would ensue in the case where funding reductions cause renegotiation of competitive FFP contracts. This renegotiation would have to be conducted on a sole source basis with the contractor, which may invite suits from competitors on the initial bid-particularly if price levels that are renegotiated approach these contractors' initial bids.

It should be noted that if non-FFP portions of the program elements that are associated with FFP contracts are reduced, this may still have a negative effect on the FFP contracts in that any changes in the delivery of these items in support of a FFP contract, e.g. government furnished equipment, testing, could also require the renegotiation of the FFP contract.

Another impact of any budget reductions causing the renegotiation of FFP contracts is the potential to cause bottlenecks in the Navy's contracting apparatus because of the renegotiation of old contracts at the expense of current program negotiation efforts.

Furthermore, the forced renegotiation of FFP contracts would severely undermine Navy leverage and credibility in its negotiation posture vis-a-vis contractors. The Navy's acquisition policy is based on full funding of FFP contracts in the POM, careful risk reduction, and the principle that the government is a reliable customer. Wholesale renegotiation of FFP contracts would deprive the Navy of this framework and reputation, making the acquisition initiatives on which we have embarked in response to Congressional pressure unexecutable.

CURRENT STATUS

In FY 1986 the Navy was allowed the flexibility to exempt FFP contracts from Gramm-Rudman-Hollings mandated reductions. Given the severe consequences of having to break FFP contracts in response to potential FY 1987 Gramm-Rudman-Hollings mandated budget reductions, it would be helpful if Congressional language could be drafted to exempt FFP contracts from Gramm-Rudman-Hollings reductions.

Mr. DICKS. It seems to me that there are certain times that there is going to be inflexibility in this process. It can't just be flexibility on what the Administration wants and everything goes over the side in terms of congressional items of interest. I think the Secretary understands what I am talking about.

There is some detente, to use an old phrase, and some understanding that maybe there can be more flexibility.

I appreciate the chairman yielding.

Mr. CHAPPELL. Thank you, Mr. Dicks.

ORGANOTIN PAINT REPORT

Mr. Paisley, last year this committee directed the Navy to submit a report on the Navy's plans for continued research on the effects of organotin paint by December 31, 1985. Almost three months past this deadline, the report has still not been received.

What is holding up the issuance of this report and when is it expected to be delivered to the committee?

Mr. **Paisley**. I anticipated your concern here and I have brought with me a witness, Nancy Stehle, who has worked on this problem. She works for Mr. Pyatt, the Assistant Secretary of the Navy for Shipbuilding and Logistics. I would like her to address this question.

Ms. **Stehle**. The report that you requested is completed. However, we have sent it back to the originator to be reviewed because of the drastic change in the price of oil. We looked at the economic analysis and decided that we needed to check that and verify that our numbers were correct in the projections.

Mr. **Chappell**. When is it expected to be submitted to the committee?

Ms. **Stehle**. The Comptroller is checking the numbers now. It is ready to be signed and the letter is in Mr. Pyatt's office.

Mr. **Paisley**. Let's make a specific commitment on the day we will have it. What will it be?

Mr. **Dicks**. What is this report again, Mr. Chairman?

Mr. **Chappell**. This is a report on the continued research on the effects of organotin paint.

Mr. **Dicks**. What does that have to do with oil prices?

Ms. **Stehle**. We were asked to do an economic analysis on how this paint could save us fuel because what it does is it prevents fouling on the bottom of ships as such, it consumes less fuel. In addition, the ship can go faster. Normally we have to bring it in every year to 18 months to have the bottom cleaned to get the barnacles off the bottom.

Mr. **Dicks**. Is there an environmental issue with the paint?

Ms. **Stehle**. Yes. There is a difference of opinion as to how large an impact it has on the environment.

Mr. **Chappell**. If I remember correctly what happened was the Senate last year prohibited the use of this paint for environmental reasons and what we are trying to do is find out whether or not there is any problem with it. Is that right?

Ms. **Stehle**. That is correct.

Mr. **Chappell**. The report will be in by the end of the month?

Ms. **Stehle**. I could say that, sir.

[**Clerk's note**.—The study was received by the Committee on April 29, 1986.]

Mr. **Paisley**. Mr. Dicks, did you have more questions on this?

Mr. **Dicks**. I was curious. The issue was that this paint has an adverse environmental impact.

Ms. **Stehle**. There is a question as to whether it has. We don't believe that it has.

Mr. **Dicks**. Can you tell us what the report says on that issue that has nothing to do with the economics?

Ms. Stehle. The report tells you what research we have done and what we are going to be doing in future years in order to be able to further define the question.

Mr. Dicks. So you are not giving an answer whether it has an impact on the environment or not?

Ms. Stehle. Not at this time. We do not believe that there will be an impact from painting the ships with organotin. The decision has been questioned and therefore we are doing additional research to try and further define what impact it does have.

Organotin is an anti-fouling paint. It does kill organisms.

Mr. Dicks. You are not telling us anything except you are going to study the issue.

Mr. Paisley. You might talk about what the report says. This material is biodegradable. The degree to which it will go into the water is a thing they have looked at. It looks like the worst problem associated with it is in the private use of it. More specifically, when the ship is brought in and the paint is scraped off they repaint the hull. That is the thing we watch carefully, but when you get into the private sector they are using it on private ships and if you scrape it, it gets into the water.

That is a problem. That is not our problem, but it is the country's problem. I understand that the report goes into quite a bit of detail on this.

Mr. Chappell. How much money are you asking for research and testing? Are you asking anything in this budget for it?

Admiral Baciocco. Nothing specifically, sir.

Mr. Dicks. If the chairman would yield——

Mr. Chappell. Let me get the answer. Is the answer yes or no on that?

Mr. Paisley. I can't tell you—we don't have a line item for it, but it can't tell you that we don't have money in the budget to spend for this because otherwise I don't know how we are going to do it. It probably is under a general research item for materials or paints.

[The information follows:]

The Navy is requesting $1,67OK in FY 1987 for research into the effects of organotin paint. The funds are to be distributed among the following program elements:

PE and title:	*Thousand*
63721N—Environmental Protection	$640
63724N—Navy Energy Program (Adv)	780
64710N—Navy Energy Program (Eng)	250

Mr. Dicks. Is this by law not approved by EPA?

Ms. Stehle. It is an approved pesticide by EPA.

Mr. Dicks. Thank you.

CHINA LAKE CIVILIAN DIRECTORSHIP

Mr. Chappell. Mr. Paisley, the Secretary of the Navy has referred to the Naval Weapons Center at China Lake, California, as "a Jewel in our crown." By that he meant that China Lake is a center of unsurpassed technical excellence, manned by a team of dedicated and highly capable experts.

Have we had any changes in the civilian directorship of that laboratory?

Mr. **Paisley**. We haven't yet, but we are about to. One of the better technical directors runs that lab, Burrell Hayes. We have set up a new organization in Washington when we did away with the Naval Material Command, and we cut out about a thousand people total, 600 out of headquarters, and about 400 in the organization.

When we did that, we set up a structure to do systems engineering. I had noticed a lack of capability in the Navy to do system engineering across a broad spectrum of systems. For example if you had a system affecting a surface ship, a submarine, an airplane and surveillance, we had difficulty pulling together the requirements and allocating the resources.

As a result, we set up an organization to do systems engineering. The best person to do the job that I know was Burrell Hayes. We requested that he come to town and phase out the directorships of our Navys labs, which we have and are putting into that organization and to come head up that operation with the intent that it probably would be a promotion for him in the end.

He decided not to do that, and so he has chosen to retire rather than come to Washington.

Mr. **Chappell**. We are, of course, discouraged that a man of this great experience and ability would be leaving the service at this particular time. He did an outstanding job out there. Wasn't he civilian technical director of the laboratory?

Mr. **Paisley**. Yes. He has done a good job as the lab's technical director.

I might relate to you a situation that brought me to the kind of thinking we have here.

When I was in the commercial sector and I had been at Boeing for about 15 years, I had just bought a new house and furnished it. I got a call from my boss who said to me, "I would like you to go to Montana. I said, "When?" He said, "Tomorrow." I said "For how long?" He said, "For about two or three years." I had to sell the house and go do the job.

When you work for a company you do what that company decides is best for the company. When you work for the Navy, you do the same thing, whether military or civilian, particularly SESers.

The SES system is set up to allow you to move SESers. One has to do what is best for the Navy, not what is best for an individual.

Mr. **Chappell**. I agree. I wondered whether or not there were any personalities involved.

Mr. **Paisley**. I don't think so.

Mr. **Chappell**. It seemed he had been there such a long time and was doing such a good job it seemed strange that he would abruptly retire.

Mr. **Paisley**. I think that there is a high percentage of the directors of our Navy labs who if we asked them to come to Washington to take a job for the Navy that is more important, might do the same thing and I would be very proud of them or our system if they did that. I think you must do what is best for the service and it wouldn't be unreasonable if we asked any technical director to come to Washington. But they get kind of comfortable in their job and say, "I am doing a good job." I say, "Of course. That is why I picked you, and I want to move you. You are called an asset and I would like to use you as an asset."

Mr. **Chappell**. Your point is either move up or get out?

Mr. **Paisley**. It is just the law.

Mr. **Chappell**. Did you give him the option of staying?

Mr. **Paisley**. No.

Mr. **Chappell**. Did you tell him either move or get out?

Mr. **Paisley**. Absolutely. Here is a promotion. A job that we need you in more than the job you are in. You will do more for the Navy in this job and therefore we request that you move.

Mr. **Chappell**. He must have been coming pretty close to the end of this career.

Mr. **Paisley**. I don't know exactly how long Burrell had been there, but he had been in government service 30 years. He had been in this specific job for 3½ years as head of the lab.

Mr. **Chappell**. Don't you find that when people near retirement, they sometimes don't want to pull up and move to Washington for what might be just a short period of time?

Mr. **Paisley**. I think some people are reluctant.

Mr. **Chappell**. But in your view there was no reasonable excuse—it would be better for the Navy to lose him than for him to just stay where he was?

Mr. **Paisley**. The technical director of that lab prior to him was asked to come to Washington and work for a couple of years and do a job; he did it. It is a reasonable thing to do.

NAVY RDT&E PROGRAM PRIORITIES

Mr. **Chappell**. Mr. Paisley, cuts in the Navy's R&D budget will be a reality this year, as they have been in past years. The budget request for this account in fiscal year 1987 is 40 percent above the level appropriated only three years ago, and 11 percent above last year's Gramm-Rudman-Hollings adjusted level, not allowing for inflation.

Would you advise this committee which Navy RDT&E programs are of a marginal or lower priority?

Mr. **Paisley**. As I mentioned in my opening statement, it is always nice to have a list of programs, and SEAFIRE is a program that we happened to kill. I wish I had a big list of them for you. My view is the highest priority programs we have in the Navy, with some exceptions, are those programs that are fixed priced. They are the highest priority. If you disturb those, you are going to pay the highest price and so I tend to say the highest priority programs are the fixed-price programs, even though I can tell you of some programs that are not in that structure.

The highest priority program in the Navy is not fixed price—the TRIDENT II/D-5 program—and there are reasons for it. But those are exceptions.

Mr. **Chappell**. Are you saying the criteria for priority is fixed-price contracts?

Mr. **Paisley**. I say, if you are going to cut into a program, the most damage you will do is if you cut into fixed price programs; therefore, I always put them on the top of the list.

Mr. **Chappell**. That means your items of priority are fixed-price contracts. Is that what you are saying?

Mr. **Paisley**. Yes.

Mr. CHAPPELL. You are not saying that a fixed-price contract in and of itself ought to be a priority.

Mr. PAISLEY. That is not the only criteria. You really look at a fixed price program if you are going to cut it. We, the Navy, will have to be in dire straits to cut into a fixed-price program.

Mr. CHAPPELL. You are saying everything that is not on fixed price is a marginal or lower priority?

Mr. PAISLEY. Yes, but there are some exceptions. The TRIDENT II/D5 program is the highest priority program we have, but it is not fixed price. There are reasons for that, reasons for there to be an exception.

But in general, I take the view that fixed-price contracts——

Mr. CHAPPELL. A lot of times some of your most important contracts can't be brought down to a fixed-price contract.

Mr. PAISLEY. That is true, but not many.

Mr. CHAPPELL. Then you don't want to use it as the sole criteria.

Mr. PAISLEY. That is right.

DSARC PROCESS

Mr. CHAPPELL. Let's look at the DSARC process. The Defense Systems Acquisition Review Council process is the Defense Department's primary mechanism for high-level approval of major weapon systems acquisition. The Defense Inspector General has recently found that the DSARC process is not being effectively controlled due to the services' use of accelerated acquisition strategies and inability to provide required DSARC documentation.

Do you believe that the DSARC process is an effective management tool and should be stringently followed?

Mr. PAISLEY. I think the important thing about any process that we have in the government is that the people that in the process are capable of making the required decisions. Any faults I have seen in the DSARC process relate to the debatable issue about whether the individual that is making the decision understands the problem adequately.

One might criticize oneself for not being able to properly present it to him. I am always reluctant to say that a person who doesn't understand me is wrong—maybe I didn't explain it completely.

I don't see anything wrong with the process. I think it should be used to be sure that the services comply with DOD policies. It should not be a place where you do programmatic judgment. That is not what OSD should be doing. That is a service responsibility and should be left in the hands of the acquisition people in the service.

My view is that OSD should be establishing policies and we should be adhering to them. They should use the DSARC process to be sure we adhere to those policies. I am not sure we use it as well as we could in that regard.

Mr. CHAPPELL. Let's look at the V-22 tilt-rotor aircraft and the SSN-21 submarine. These programs effectively entered full-scale development in fiscal year 1986, although neither program has been approved for this critical phase by the DSARC.

How was this justified?

Mr. PAISLEY. That isn't the situation. On the V-22, we are having the DSARC next Wednesday to get approval to go into full-scale engineering development.

Mr. CHAPPELL. Then it has not been brought to that point?

Mr. PAISLEY. No. It is going to the DSARC next Wednesday.

Mr. CHAPPELL. The staff tells me that the contractor has had over a thousand people working already on full-scale development for about a year.

Mr. PAISLEY. If he has been working on any full-scale development, he has been doing it at his own risk because the full-scale engineering development commitment will not be made until next week, if then. I think it will be made, but not until then.

On the SSN-21, it is a different situation because there is a ship and combat system—Admiral Baciocco, why don't you address the design?

Admiral BACIOCCO. Generally in shipbuilding, there is no formal commencement of full-scale engineering development per se. There is a Milestone II in the DSARC process which generally matches the commencement of what is called contract design. In the case of the SSN-21, we had the necessary meetings with OSD and the DSARC principals last June, and went through that Milestone II review and with their concurrence proceeded with the commencement of competitive contract design, which we are in today. We just had a program review on the SSN-21 and the combat systems last week, again with the DSARC principals, which was satisfactory.

Mr. CHAPPELL. What about the Submarine Advanced Combat System? It is my understanding the Navy will hold a program review instead of a full DSARC review on the significantly restructured program.

A program review is much narrower in scope than a DSARC review and does not require a Secretary of Defense decision memorandum.

Given the importance of the restructure, why isn't a full DSARC being held?

Admiral BACIOCCO. Last week, sir, there was a program review on the Submarine Combat Systems Program, not only the BSY-1, which is the combat system which goes into the fiscal year 1983 SSN-688 class, but also our plans for the SSN-21's combat system. It was preceded by a very thorough briefing to all the DSARC principals on the elements of test and evaluation, reliability and maintainability, everything that precedes a DSARC. This meeting with the DSARC principals went very satisfactorily last week, and it is our understanding that the SDDM, the SECDEF decision memorandum, is being drafted as we speak.

SEAFIRE

Mr. CHAPPELL. What about the SEAFIRE program? The committee is advised that the Navy has terminated the Seafire electro-optical gunfire control system. Is this accurate? If so, why is the program being terminated?

Mr. METREY. I am Dick Metrey. I work for Mr. Paisley in the area of surface warfare. The reason is cost and priority. We were directed by Congress to support SEAFIRE if we could arrive at a unit cost in production of $4 million or less. We have not been able to do that. Our projections do not allow that. We have asked the prime contractor for a not-to-exceed cost. For the quantity that we are now programmed to buy, which is approximately 60 units (to go on the DDG-51 class and the DD-963 class ships) we cannot achieve that $4 million per unit cost requirement.

We come out about $5.2 million.

Mr. **Chappell**. Why is that? Is that because you were off on the estimates to begin with, or because the price has escalated that much, or is there something wrong with the program?

Mr. **Metrey**. No, sir. We are going by the not-to-exceed cost of the prime contractor.

Mr. **Paisley**. I suspect——

Mr. **Chappell**. So you are cancelling it strictly for affordability reasons?

Mr. **Paisley**. Yes.

Mr. **Chappell**. Do you expect to pick it up at a later time?

Mr. **Paisley**. I don't think so. If we had applied the policy that we have developed now on this program four years ago, we would not be here with this program. We would have it on a fixed price contract for the full-scale development. We would have a price on it that was acceptable or we would have stopped then rather than now, and we would have had not-to-exceed options in production.

It is not the way to do business. The way we do it now is the way.

Mr. **Chappell**. This is not an essential program then?

Mr. **Paisley**. It just has a lower priority. We are going to use air designators and MULES (Modular Universal Laser Equipment) on the beach. You get a designation from an aircraft.

Mr. **Chappell**. How much money have we spent on the program?

Mr. **Metrey**. We have spent, with the current prime contractor, approximately $50 million.

Mr. **Chappell**. What do you intend to replace it with? Anything?

Mr. **Paisley**. We are not going to use a shipboard designator.

Mr. **Chappell**. Will this have any effect on the DDG-51 shipbuilding program?

Mr. **Paisley**. I hope not.

Mr. **Chappell**. $21.9 million was appropriated for SEAFIRE in fiscal year 1986. However, the fiscal year 1987 budget only shows $13.6 million in the fiscal year 1986 column.

Have these funds been reprogrammed? If so, to which accounts and in which amounts?

Mr. **Metrey**. We have not reprogrammed the funds to date. We have done some minor adjustments to the funding, no more than approximately $200,000, but we have not reprogrammed the funds to date.

Mr. **Chappell**. What do you mean by minor adjustments?

Mr. **Metrey**. There are sometimes needs for funding for minor budget adjustments due to such things as inflation rates that come along and we have to modify all programs across the board, but this has been a minor amount of money. So the funding—in essence—is intact. We have in 1986, of course, spent some of the funding with the prime contractor and for support.

Mr. **Chappell**. Does the Navy consider SEAFIRE to be a non-special interest program of the Congress as defined in the law?

Mr. **Metrey**. Sir, the Congress has had language on SEAFIRE for about two or three years running, so we certainly do not consider it a non-special interest program. There is a letter right now which has gone up to the Secretary of the Navy, for his signature to advise Congress of our action.

Mr. **Chappell**. And ask for its approval?

Mr. **Paisley**. To advise probably. We could not meet the requirements as required by the act last year. That is one of the things that guided us to where we are.

Mr. **Chappell**. It is regarded as a special interest program?

Mr. **Paisley**. If somebody asked whether the Congress has a special interest, I would have to say yes.

Mr. **Chappell**. Have you made up to your mind as to how you are going to utilize the $13.6 million of fiscal year 1986 funds?

Admiral **Baciocco**. The Authorization Conference Committee report last year directed that if SEAFIRE's unit cost exceeded $4 million, that the Navy should terminate the program and explore alternatives.

As Mr. Metrey said, we have taken action to terminate the program. We have the correspondence in process to notify the Congressional committees of our action. We are looking at the dollars that remain with regard to any close out costs that need paying. Whatever dollars remain—and I don't have the details—would be used to explore any alternatives there may be that we would be interested in. We would then let you know what our intentions are for the remainder of the resources.

Mr. **Chappell**. What about the MARK-86 FCS? Are you asking for funds for this in fiscal 1987?

Mr. **Metrey**. The MARK-86 Fire Control System is on the DD-963 class ships. In order to utilize the guided projectile in the indirect fire mode (the mode that you would not need SEAFIRE for), to support Marine Corps amphibious landings, we would have to make slight modifications to the MARK-86 Fire Control System.

This is programmed and we are going on with that, but this is not affected by the SEAFIRE program ———.

Mr. **Chappell**. So the SEAFIRE decision has nothing to do with this?

Mr. **Metrey**. The SEAFIRE decision does not compromise the main mission which is in support of the Marine Corps on the beach, the indirect fire mode with the guided projectile.

LOW COST SEEKER

Mr. **Chappell**. You are requesting $14.7 million to continue development of the low-cost seeker. A companion request of $14.8 million has been made by the Air Force.

What is the status of this program?

Mr. **Rumpf**. Mr. Chairman, the program technically is on target. The Secretary recently sent a letter to the committees endorsing the program and its stability relative to the technical progress that it is making.

So it is still being planned as a block improvement for the HARM weapons system in the latter part of this decade as the hardware upgrade to the system at that point in time.

Mr. CHAPPELL. China Lake is managing it?

Mr. RUMPF. That is correct.

Mr. CHAPPELL. It appears that the Naval Weapons Center's efforts have been hampered by the late release of funds by Navy headquarters, resulting in an artifically low obligation rate. Is that true, and if so, why has it occurred?

Mr. RUMPF. Part of that was the result of the fact that moneys that were expected from the reprogramming in the fiscal year 1984 budget could not be used until those moneys were released for this effort, which was the Congress' will. Not all of those funds ended up coming into this program. China Lake held the funding on the work statements for the amount of project work that needed to be done with the two contractors, Ford and Raytheon so they would have enough money in hand to execute these work statements as they were needed.

So, because of the late decision on the ultimate reprogramming authorization from the Congress to the Department of Defense, China Lake devised an approach to get all the work done. In fact, they have maintained the schedule.

As I said before, they are on schedule in terms of the work being delivered from the contractor, but it did in fact create an artificiality in the obligation rates, which is the reason why the Comptroller and OSD reduced the program when it came forward to us because of the legitimate reason that obligation rates were lagging.

Mr. CHAPPELL. Are you going to integrate this system into HARM?

Mr. RUMPF. Yes, sir.

Mr. CHAPPELL. When?

Mr. RUMPF. Before the HARM buys out in fiscal year 1990. The current plan on the total quantity between the Air Force and the Navy, we would be ready for first production of this system in fiscal year 1989, so at the time it can catch part of the 1989 buy because it is late in that sequence and also what is left in 1990.

What is yet to be determined is based on effectiveness whether we would go back and retrofit earlier HARMs with this improved capability or also incorporate the same capability, which is vastly superior in terms of part count and simplicity into a follow-on system is an issue that we have been addressing with the Office of the Secretary of Defense. This will largely be determined by the effectiveness of the weapon.

Mr. CHAPPELL. Why wouldn't it make good sense to accelerate the LCS?

Mr. RUMPF. It has been accelerated as fast as possible. Throwing more money at it would not accelerate progress because it is a packaging job.

China Lake has always had the money needed for the design. The issue has been how fast that can be packaged. Each of the contractors might be able to accelerate by a few months over the current schedule that China Lake is projecting, but it is only a few months at best.

Mr. **Chappell**. Have some of your people advocated going sole source on HARM?

Mr. **Rumpf**. HARM currently is sole source to Texas Instruments.

Mr. **Paisley**. Your question, Mr. Chairman, is whether we are considering going sole source to a lower cost-seeker.

Mr. **Rumpf**. I am sorry, sir.

No, as a matter of fact, the only thing that has been discussed is whether the two contractors who are currently building six units each for test capability would continue to compete with one another after they submit their costs for the next phase and for production. We are considering competing the contract again so that you would have still two sources being carried forward.

But there has not been any discussion on necking down to a single contractor.

Mr. **Chappell**. But some have suggested you turn this program over to the sole soure HARM contractor, right? You are not going to do that?

Mr. **Rumpf**. We are not going to do that, no, sir.

Mr. **Chappell**. Mr. McDade.

E-6 A TACAMO AIRCRAFT

Mr. **McDade**. Thank you, Mr. Chairman.

Let's talk about the E-6A. The E-6A TACAMO aircraft is currently in full-scale development. Critical design review for the E-6A was scheduled for July 8, 1985. When was it held and what were the results?

Mr. **Paisley**. It is a pleasure to see you again, Mr. Congressman. I am sorry I haven't seen you during the year as much as I would like.

I would like to have Mr. Wang address the question.

Mr. **Wang**. I don't know the exact date when the technical design was held, but I will find out for the record.

Mr. **Paisley**. We will get that for you, the exact date.

[The information follows:]

E-6A Critical Design Review. The critical design review for the E-6A was conducted during the period 8-11 July, 1985.

Mr. **McDade**. Are any aspects of the design being reworked as a result of the review? Do you know the answer to that one?

Mr. **Wang**. When they integrate boxes into any kind of a platform——

Mr. Dicks [presiding]. Are you talking about computers?

Mr. **Wang**. Any kind of a device. The thing you have to be very careful about is that you do not get into the position where you have signals interfering with each other. So there are a couple of areas which we are looking at very, very carefully which are hardening and mutual interference inside the devices.

Those are areas that would have to be managed very, very carefully.

Mr. **Dicks**. Total RDT&E costs for the E-6A were stated last year as $386.1 million. The fiscal year 1987 President's budget states a total cost of $267.6 million. What caused this large decrease in the estimate?

Mr. Wang. When we compete, we cost the aircraft. We decided on two aircraft per year. The company came in and made an offer. The company came back and said it would be better to go 2, 3, 3 and 6, and they came in with a program of $62 million per aircraft.

Mr. McDade. According to the budget justification material, it seems as though the Navy plans to conduct no operational testing of the E-6A prior to approval for production in about February of 1989. Is that accurate?

Admiral Baciocco. Mr. McDade, that is not entirely accurate. There will be no OPEVAL, or full-up operational test period, because of the way this program has evolved. However, our independent tester is involved in the developmental testing. He is reviewing and witnessing some of the operational testing being conducted ——— aircraft which, while not a TACAMO aircraft is the same airframe. In addition, he has reviewed and will report on all the other operational testing that has been done on that basic airframe. The communications suite which is going in the E-6A, is one that is proven and has been tested by COMOPTEVFOR on the EC-130. We will, of course, after we get the E-6A out there with that communication suite, have a final OPEVAL of the aircraft. In addition to the formally imposed operational assessments and testing throughout the entire program.

Mr. McDade. Can you tell us how many E-6A's are in the procurement plan for fiscal year 1986 through fiscal year 1989?

Mr. Wang. The plan is to have one R&D aircraft and then there will be 2, 3, 3 and 6 total.

Mr. McDade. Is that 15 aircraft?

Mr. Wang. Yes, sir.

Mr. McDade. What portion of the total fleet does that represent, those 15 aircraft?

Mr. Wang. That is the total E-6 fleet.

Mr. McDade. That is all of it?

Mr. Wang. That is all.

Mr. McDade. What is the Navy's assessment of the E-6A technical risk?

Mr. Wang. I think I stated earlier that the technical risk is simply to make sure that we manage the equipment integration properly. Otherwise, risk is minimal.

Mr. Paisley. This is a low-risk program. This is absolutely a low-risk program. I will just tell you it is going to work. It is not like we are inventing something. The problems that Hubert talked about are problems, but this program is going to work. It is low-risk.

Mr. McDade. That is great news.

The FY 1987 budget includes $81.7 million for development of the E-6A, which is an increase of $5 million over last year's projection. However, the full-scale development contract includes not-to-exceed prices, and these were established eighteen months ago. Explain the justification for this $5 million increase, and describe whether any portion of the increased funds is required for the FSD contract.

[The information follows:]

R&D Program cuts in FY 85, which occurred after budget submission resulted in deferral of scheduled design engineering. The $5M increase requested in FY 87 is required for the FSD contract and to preserve the FSED schedule upon which the not-to-exceed prices are based. The $5M does not increase the not-to-exceed price.

Mr. McDADE. For the record, please provide results of DT-IIIA testing to date, a well as results from ———.

[The information follows:]

There has been no DT-IIIA testing to date. The assembly of the test facility to support DT-IIIA commenced in September 1985. By February 1987 we expect to have results of the testing conducted in this facility, which is integration testing of the communications suite in the E-6A test bed. ———. Results are being analyzed and are not available at this time.

Mr. DICKS. On the question of EMP, EMI, and VLF integration for the E-6, are you looking at experience on the E-4 and the E-3 program?

Mr. PAISLEY. Yes.

Admiral Baciocco, could you please comment?

Admiral BACIOCCO. From a technical sense, I am sure the contractor and our program office and our operational tester are reviewing the experience in testing those aircraft, so from an operational point of view, we can feed that back into what we are doing.

Mr. DICKS. Last year when Congress went ahead and approved this program in the conference, we also agreed to put some money in for an upgrade on the airborne command post, as I understand, because GAO or someone had raised a question about that.

Mr. PAISLEY. It is the same contractor.

Mr. DICKS. But it is not in the same contract—so you are not aware of the status of that program?

Mr. PAISLEY. I am not, but it would amaze me knowing the structure of how the programs are worked if those things aren't all tied together. Probably the same office at Boeing is working the problem.

Mr. DICKS. Thank you, Mr. McDade?

V-22 ENGINE

Mr. McDADE. Let's speak for a minute about the V-22 engine, please.

The Navy recently announced the selected design for the V-22 prime engine. The Air Force, which plans to procure 80 V-22 aircraft for the long-range special operation mission, has calculated that this aircraft will have a combat radius of 450 nautical miles with this engine. Their requirement is 700 miles.

Does the Navy believe that the decision of this engine places in jeopardy the Air Force's planned procurement of the V-22?

Mr. PAISLEY. Dick, do you know the range with that engine?

Mr. RUMPF. Without any internal tanks or external tanks, 449 nautical miles, as you have quoted, Mr. McDade, is correct.

Mr. PAISLEY. As I recall, the Air Force talked about a requirement that would be acceptable on the order of 500-some miles, even though I do know the 700 was stated at the start.

I think it is important on a joint program like this to take into account other service's requirements. It makes no sense, however, to take a requirement that is a small hang-out and have it affect the cost of the entire procurement. The engine selection was based on what you need to do the job and the objective not to spend more money than you need.

We were very tough on this. The Secretary himself picked up the procurement and made that decision. It was "Do not pay more for more, but pay for what you need."

Now it looks like that contractor, Allison in this case, has brought on board Pratt & Whitney as the second source and the second source on this engine came at no cost to the government. It was an offer to all three contractors—a very good procurement, a classic example of how you ought to do things.

AV-8B AND F/A-18 NIGHT ATTACK

Mr. **McDade**. Let's talk about the night attack upgrade.

The Navy is requesting $34.7 million in fiscal year 1987 to continue the night attack upgrade for the AV-8B and F/A-18.

Congress reduced the fiscal year 1986 budget request for this program by $6.1 million. What was the impact of this reduction on the program's overall schedule, cost, and performance?

Mr. **Paisley**. First, let me say that the requirements and the capability is extremely valuable. I have been involved in missions at night. The system gives you low altitude capability. It is going to be a tremendous asset to the Navy and I think that you will see that capability creep into new airplanes.

Let me have Dick address specifically that shortfall.

Mr. **Rumpf**. Mr. McDade, we have capped the overall capability between the AV-8B and the F/A-18. We have made this a package proposition for night attack, and have a reprogramming under threshold up to the $4 million to cover this to try to hold schedule on the AV-8B side of the ledger, which is the pacing element of the two items.

Mr. **McDade**. Is that a $90 million cap?

Mr. **Rumpf**. The total cap—that is correct, between the two programs, between the F/A-18 and the AV-8B for the night attack capability.

Mr. **McDade**. Are the British sharing part of the cost?

Mr. **Rumpf**. Forty percent of the common items on the AV-8B, while we pick up 60 percent. The deal is that they developed the FLIR at no cost to us and we are buying the FLIR for the AV-8B's.

Mr. **Paisley**. The deal was we would put it in the AV-8B, they would develop it at a cost and compete it with a U.S. firm for the balance of systems for the F/A-18.

The Secretary looked at the requirement carefully and said it looks like something we really need and here is how much we can afford, but we can't afford more, so see if you can do it. If we had picked more, we would have spent more. It was a good way to do it.

Mr. **McDade**. As we look at the funding requests, 1987 funding for the AV-8B portion of this program was estimated last year to be $12.6 million. The fiscal year 1987 President's budget includes finding of $22.5 million. What has caused such an increase?

Mr. **Franklin**. I really don't know where that change came in.

Mr. **Paisley**. We will certainly give you that answer.

[The information follows:]

Initial budget estimates indicated a FY-87 requirement lower than the present estimate. For example, the original budget estimate over two years ago for the AV-8B portion of the Night Attack Program was spread over FY 84-86 with no funding in FY-87. As program definition grew, collaborative discussions with the UK initiated, and the FY-85 Appropriation Act with an amount lower than the FY-85 estimated requirement was passed, the spread of required funding has out of necessity migrated into FY 87-88. (While no funds were officially requested in the FY-85 President's Budget and $12M was eventually appropriated, the estimated requirement provided by the Navy at that time was $23M as reflected in FY-85 SAC language.) The $12.6M referred to in the question was the estimated requirement for FY-87 in late 1984 and was based on the assumption that the FY-86 funding would be $27.9M.

Last year the total estimated Navy cost of the AV-8B Night Attack development program was $55.0M. This equated to the AV-8B share of the $90M cap imposed by the Secretary of the Navy on the combined AV-8B and F/A-18 Night Attack development. Last year, $6.1M was taken out of the AV-8B Night Attack program by the FY-86 appropriation process. In addition, Contractor's proposals have been refined and this has caused a realignment of the funding requirements. The result is that the AV-8B share of the $90M has been reduced to $52.0M and is spread over FY-84 through FY-88 as follows: (F/A-18 funding is also included.)

[In millions of dollars]

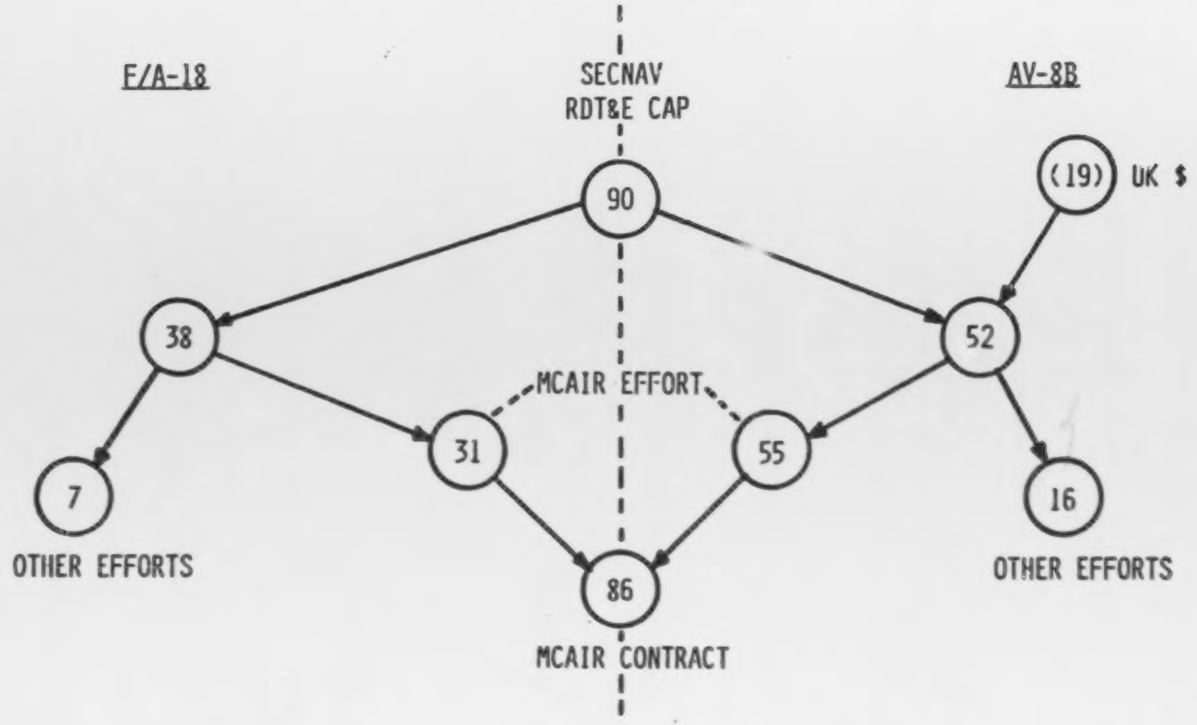
	Fiscal year—					
	1984	1985	1986	1987	1988	Total
AV-8B	$2.1	$11.8	$15.0	$22.5	$0.6M	$52.0
F/A-18	0	10.2	14.1	12.2	1.5	38.0

Note.—See attached diagram for clarification.

UNCLASSIFIED

NIGHT ATTACK

RDT&E FINANCES ($M)


F/A-18
SECNAV
RDT&E CAP
AV-8B
90
(19)
UK $
38
52
MCAIR EFFORT
31
55
7
16
OTHER EFFORTS
86
OTHER EFFORTS
MCAIR CONTRACT

Mr. McDade. When does Navy expect to complete negotiations with the British Ministry of Defense over the amount of costs they will assume in this program?

[The information follows:]

With the exception of a few minor issues that are now being resolved, negotiations were essentially completed in January 1986. The discussions in January centered around the extent of commonality definition that is necessary in order to determine the UK financial contribution. The draft agreement is currently in staffing within the UK and a final agreement is anticipated by the end of April 1986.

Mr. McDade. Thank you, Mr. Chairman.

SATELLITE LASER COMMUNICATIONS

Mr. Dicks. For several years, the Navy and DARPA have been examining the possible use of blue laser communications with our submarine forces.

What is the status of this effort and what is requested in the budget for the program?

Mr. Paisley. I think Admiral Baciocco should discuss that. We had a long discussion on this subject about two weeks ago.

Admiral Baciocco. Mr. Chairman, you are correct. For several years the Navy and DARPA have had a technology development demonstration program which today is known as the SLC program, Satellite Laser Communications program. We have been investigating the ability to communicate from an airborne or ultimately, perhaps, a space platform to a submerged submarine. We have been proceeding to work on a blue-green laser, the wave length of which transmits through water rather well.

Two years ago, the National Academy of Science's Naval Studies Board and the Secretary of the Navy's Naval Research Advisory Committee became aware of some breakthroughs that had been made in the scientific world in the area of Xenon Chloride lasers and atomic resonance filter receivers which are sensitive in the blue light wave length. Based on their recommendation, we shifted our program to explore blue lasers.

Our feeling was that if we were going to make the investment in a technology to communicate with submarines one should be able to communicate with any type of submarine worldwide, and so our program has been paced to that.

To date, we have demonstrated communications with submarines from airborne platforms using a blue-green laser in the waters off of California, in the waters off of Hawaii, and through clouds. We are this spring going ———.

We have programmed to follow that up next year with blue laser experiments from an aircraft to a submarine———

Mr. Dicks. These were blue-green?

Admiral Baciocco. The original ones, yes.

Mr. Dicks. So you haven't done this kind of operational test with the blue laser, right?

Admiral Baciocco. We have not, sir, and they are technical tests as opposed to operational tests. We plan to go ——— in the late calendar year 1987, early fiscal year 1988, to do the final element of the testing we feel is necessary to commit to a major systems development, and that is testing with blue lasers ——— to a submarine.

DARPA, on their own, is funding the development of a blue laser, a space qualifiable blue laser, which is to be complete at the end of fiscal year 1987. That will be a design that hasn't been tested in space, but is qualifiable to go to space. We will have the design drawings so that we can go out and seek competitive proposal if we choose to go to a procurement program at that time. At the same time——

Mr. DICKS. Are there technical questions yet? You said you are going to test ———. But are there significant technical issues that have not yet been resolved in this program?

Admiral BACIOCCO. I believe that until we go through the methodical development of the technology, one would have to say yes. There are optimists who say we are ready to go to space today, but I should tell you that a communication system from space is not a single satellite and a single laser. We do not have the design or testing of a laser qualified to go to space today. We are working on conceptualizing what a system would be to provide one the necessary reliability and redundancy to have a strategic and tactical communications system from space.

It would not be one satellite or one ground station. We are going through those studies at the present time so when we finish the technical testing that has to be done to give us the confidence to make a substantial investment, we will have our homework completed and be ready to go.

Mr. DICKS. Is this two years away? Three years away? Five years away?

Mr. PAISLEY. When you say away, are you talking about an operational system?

Mr. DICKS. What kind of a time frame? Before you would be ready to make a decision to put together an operation? I have heard some people suggesting that this is the great answer and we ought to just move right out smartly with it.

What I am hearing you say is that the Navy feels that it would be more prudent to pace this program a little more slowly until you have dealt with these technical issues in a responsible way. Is that what I am hearing?

Mr. PAISLEY. Let me try to state it specifically. If we didn't have any capabilty at all, you could do risky things. We have a program and it is a low-risk program. This effort will get us to a point where we can make a decision to implement this program in 1988, but before then we have to eliminate the risks in the program, the unanswered questions.

It is a very good program, but we are talking about two different time frames. This program is a future program. It is not a today program. We should pursue this program the way we are. It could show great benefit in the future. It is not here today.

Mr. DICKS. So you are suggesting we should go ahead with our E-6A improvement?

Mr. PAISLEY. I would.

Mr. DICKS. Some have suggested that we leap over the E-6A and go right to the blue laser program.

Mr. **Paisley**. We wouldn't recommend it. That is not our recommendation.

ELF

Mr. **Dicks**. I think that is a very sound judgment. Tell me about ELF. How are we doing with that at this point? Is that an operational system? You are still doing R&D on it, aren't you?

Admiral **Baciocco**. We are still doing some R&D, but it is in effect partially operational and we have the ability to communicate with those submarines that have ELF receivers.

Mr. **Dicks**. Was that program worth doing in retrospect?

Admiral **Baciocco**. Oh, absolutely, Yes, sir.

UNIVERSITY LABORATORY CONTRACTS

Mr. **Dicks**. On August 30 last year, I was advised of a decision you had made to discontinue the sole-source contractual arrangement between the Navy and some university laboratories, including the Applied Physics Lab at the University of Washington. The decision was apparently based on recommendations contained in a Navy Research Advisory Committee report which regarded labs as necessary, highly responsive, and almost impossible to replace.

Could you discuss the decision and whether further examination is being given to this question?

Mr. **Paisley**. We looked at these with the following question in mind, are these university laboratories unique? Do they represent a unique capability?

Second, given it is a unique capability, is the quality of work we are getting what we would like to have and lastly if it is not unique, then to what degree could we compete it. We looked at four university facilities. They have grown out of requirements the Navy has had from World War II.

I think we have a plan that makes sense. I never knew you could get universities so mad, by the way.

I would like to have Jim Gaines address this.

Mr. **Gaines**. My name is Jim Gaines. I work for Secretary Paisley.

The study had a firm base in that it appeared that there were tasks being given to the Navy-funded universities that violated the competition in contracting law. In other words, some tasks——

Mr. **Dicks**. Could you put in the record your legal analysis for that conclusion.

Mr. **Gaines**. That was a feeling, sir.

Mr. **Dicks**. We don't deal in feelings here. Either you have a legal analysis or you don't.

Mr. **Gaines**. I do not have it with me.

Mr. **Paisley**. We will put it in the record.

[The information follows:]

The Competition in Contracting Act of 1984 (CICA) provides an exception to full and open competition where a determination is made that it ". . . would be in the interest of national defense in establishing or maintaining an essential engineering, research, or development capability to be provided by an educational or other nonprofit institution or a federally funded research and development center."

Since each of the university laboratories in question has an omnibus contract under which a variety of tasks are performed, a technical evaluation of the work

being conducted at the laboratories is presently underway in order to determine which tasks being performed conform to the provisions of CICA relating to exceptions to full and open competition. It is inevitable that the strength of the justification for contracting on a sole source basis will vary from task to task.

In some cases the laboratories will be the sole source for the effort; in other cases the Navy may conclude that the work should be performed at a Navy laboratory, or that the task can be procured on the basis of full and open competition. As the review of the tasks continue, it is quite likely that the university laboratories will be sole sources for particular tasks.

Mr. Gaines. There are many functions at the University of Washington and the University of Texas that are very valuable to the Navy and we intend to continue portions of that sole-source contract.

What we are doing now is analyzing the capabilities of those institutions and trying to get a better handle in coming up with a better contract method for them.

The sole-source omnibus contract was a catch-all contract and allowed a task creep, if you will. We could get tasks there easily and some should not have gone there. Soon we will have an answer to the universities.

Mr. Dicks. Why was the APWAU contract singled out?

Mr. Gaines. There were three under scrutiny: University of Texas, Washington and Scripps Institute.

Mr. Dicks. Is similar action planned for all Navy sole-source contracts?

Mr. Paisley. Let me finish the question on APL. A year ago, I set up a system to look at all the tasks that go into APL Johns Hopkins. I said I want a mission described unique to that institution and a judgment on every task as to whether it could go to a Navy lab before we send it to APL. We do that now for every task. We look at every task from that viewpoint.

Mr. Dicks. I have been told that the Competition in Contracting Act, Public Law 98–72, was part of your decision. I am told that the CICA contains an exception provided specifically for laboratories such as those which recognizes the need for maintaining essential research capabilities.

Has this exception been considered for the Applied Physics Laboratories?

Mr. Paisley. We owe you what you asked for before, our legal analysis of it, but we looked at the uniqueness of the university in terms of their capability and with the unique capability, you could fund it directly. You don't have to compete it, and that is what we did.

So what we are doing now is carefully looking at those tasks that are unique to that university that we in fact need. We did look at that.

CENTER FOR NAVAL ANALYSIS

Mr. Dicks. There is one other question I will ask.

The Navy utilizes the Center for Naval Analysis to perform an independent assessment of a wide range of research issues. Could you describe the value of the role played by the CNA for the Navy?

Mr. Paisley. Yes. It has an interesting history. My involvement has been over about five years. When I first came into the Department, CNA was having trouble really getting coupled into the

Navy. They had been functioning for some time. We recompeted the contract and got a different management team in there, but we didn't change professional staff. We just changed the management people. It shows you that sometimes if you improve the management you have a hell of a lot of capability.

Presently, we have more work to take over there than we can handle. They are closely coupled with the Navy. They have traditionally been a very strong element for helping the Navy and Marine Corps.

General Franklin, you might want to say something about it.

General **Franklin**. A portion of CNA, 25 man-years, is called Marine Corps Operations Analysis Group (MCOAG). We keep four of the MCOAG people in the field. For example, at MAWTS-1, we have a fellow who analyzes air-to-air combat on the air combat range and he has done tremendous work in finding out what happens in one versus one, two versus two air battles; who kills who; and why.

We always knew when we sorted it out on the ground who had won, but it was hard to tell why. We also keep a guy at 29 Palms to look at the ground side to tell us why things happen in a ground battle. MCOAG has been a very, very strong player in the Marine analysis and it is a small piece of CNA.

Mr. **Paisley**. I think the Center for Naval Analysis is a real plus in the Navy now. It is a way to get an analysis by an unbiased group. We don't always get the answer we are looking for.

We do it within a controlled salary structure. We approve the salary structure. I might say it is the lowest salary structure of any FCRC. There are eight of them, I think.

Mr. **Dicks**. Like Rand?

Mr. **Paisley**. Right. We watch it very carefully. I am head of the review council for CNA. We review their work four times a year and approve their program plan. We put taskers there during the year, but they are a small percentage of what we do. It is a first-class operation managed by the Hudson Institute.

Mr. **Dicks**. For the record, I understand that a number of their recommendations have resulted in substantial cost savings in Navy and Marine Corps programs. If that is true, I would like you to lay some of those out in the record and a little bit of the effort that you have gone into in trying to restructure the relationship and why you think it has been positive for the Navy and the Marine Corps.

Mr. **Paisley**. It was the Center for Naval Analysis that ran our recent study on how to develop surge capability in the Department of the Navy and it looks like the DOD is going to pick up on its recommendations, so let me quickly describe one case.

We went to the contractor of the MK-46 torpedo and we said, "If we had a war coming on and we had a surge requirement, how long would it take you to go to a tenfold increase in your torpedo production capability," They said, as reported in the study "It would take 24 months and cost about $23 million for additional facilities."

We said, "Let's give you some new ground rules. We do not want you to build a 20-year shelf-like torpedo because there is a war on now. It is an emergency. We recognize you will have no trouble getting three shifts of people. We will change the test program, and get Congress to waive some of the OSHA and EPA requirements you have. Make the assumption we can do it and give me a new answer."

The answer came back that it would cost $6 million and we (the company) can do it in four to eight weeks. We said to ourselves, "That's the way to get surge capability."

Se we are currently writing new wartime specifications. We are going to build torpedoes this way, and test them.

Mr. DICKS. Why don't you use those in peacetime?

Mr. PAISLEY. Out of this test case will come some of that. I am convinced that out of this will come improvements in the specifications on some of our systems.

We are looking at Sidewinder and Sparrow now and the Army is looking at mines. This effort has been a real plus.

CNA did that and we will give you some additional details you are asking for for the record.

[The information follows:]

The Center for Naval Analyses (CNA) is the Navy's only Federally Funded Research and Development Center (FFRDC). An independent group responsive to top-level Navy needs, it provides objective analyses of Navy and Marine Corps issues, ranging from tactics for today's forces to selection of advanced technology for future forces. CNA expertise is founded on a long association with the Navy since 1942. The essential ingredient of CNA's work is independent, realistic approaches to problems, based on first-hand knowledge of Navy and Marine Corps operations. Examples of CNA results that have significant cost avoidance implications follow.

LAMPS MK III Spare Parts.—CNA evaluated alternative models for determining proper mix of spare parts. CNA model has been adopted by Navy.

AVCAL (Aviation Consolidated Allowance List).—CNA developed a model of optimizing mix of spare parts for carrier air wings that is now being used by a deployed carrier. Potential wartime readiness increase would be 13%.

SRB (Selective Reenlistment Bonuses).—CNA found that every dollar spent on SRB saved $2.50 in recruiting and training costs. Results helped to keep Navy's SRB program from being cut in fiscal year 1984.

Mix of Personnel in Aviation Squadrons.—CNA assessed relative contributions of first-termers and career personnel to squadron effectiveness and recommended an optimum mix to achieve more effectiveness per dollar. CNA's recommended mix is being tested.

Mix of Amphibious Forces. Navy-Marine Corps conducted a study of mix of amphibious ships and ship-to-shore assault vehicles; CNA provided major analytical support. CNA's analysis showed redundant capabilities that could be eliminated at little risk. Navy, Marine Corps, and OSD agreed on new, more efficient mix of ships and vehicles.

Active/Reserve Force Mix.—CNA developed a model to evaluate the relative cost and manning feasibility of Navy mission transfers to the Navy Selected Reserve.

SRGA (Selected Reserve Growth Attainability).—CNA constructed a model to calculate the relative costs, initial training requirements, and accession program mix for any Selected Reserve force structure.

Recruit Screening.—CNA developed automated screening tables for controlling attrition.

Delayed Enlistment Program.—CNA established the value of the Delayed Enlistment Program (DEP) as a pre-entry screening and post-entry retention device.

Apprenticeship Training.—CNA demonstrated that eliminating apprenticeship training would save training costs and increase apprentice man years in the fleet.

Recruiter Assignments.—CNA recommended revising the allocation of recruiters across Navy Recruiting Districts to capitalize on Delayed Enlistment Program rather than to equalize direct shipments of recruits.

Drug Use in the Marine Corps.—CNA conducted a study of the effectiveness of urinalysis as a deterrent to drug use in the Marine Corps. CNA's analysis found that increased drug testing reduces drug use. While discharging all drug users will reduce drug use, one more urinalysis test per Marine is equally effective but costs less.

SEA LANCE

Mr. Dicks. Secretary Lehman advised the committee this year that Navy programs will conduct full-scale development under fixed-price contracts with few exceptions. The committee notes the Sea Lance program is planning to enter full-scale development in May 1986 under a cost-plus contract.

On what grounds is this program justified as an exception to the Navy's recent policy change?

Mr. Paisley. I have asked that the program be reviewed to ascertain to what degree we feel that program can meet our new requirement. We are going to look at it. We picked it up already. I think if we ascertain the risk is low enough, we will fixed price it.

Mr. Dicks. Will there be a delay?

Mr. Paisley. In the program? Not based on what I am talking about, there won't.

Admiral Baciocco. The program presently plans to shift to a fixed-price-type contract at the time of the critical design review which is in mid-1987.

Mr. Dicks. Let me ask you something else.

In January 1980, DOD approved the requirement of the ASW Standoff Weapon, recently renamed Sea Lance. As a justification for Sea Lance, this document stated that one deficiency of the current ASW standoff capability was that the existing system "uses only a nuclear warhead and its use may be constrained by political factors in wartime scenarios."

The requirement indicated that the sea Lance should emphasize a conventional warhead as the primary warhead. However, in 1982, the Navy decided to pursue a nuclear depth bomb as the primary warhead and consider the conventional warhead later as a product improvement.

Is the conventional payload a funded development activity? If so, provide a funding profile for all available years.

Admiral Baciocco. Yes, sir, Mr. Chairman.

The M-50 torpedo will be the conventional payload for the Sea Lance ASW standoff weapon. The timing of the introduction of that torpedo will follow the IOC of the nuclear variant Sea Lance ASW standoff weapon.

[The information follows:]

The MK-50 torpedo is a funded development activity. The funding profile for integration of the MK-50 torpedo with Sea Lance is provided below:

[Total year dollar in millions]

	Fiscal year 1988	Additional to completion	Total
MK-50 integration with Sea Lance	$4.5	$104.6	$109.1

Mr. Dicks. I don't understand. Why would you go with a nuclear version first?

Admiral Baciocco. For years we have had a SUBROC, a submarine rocket propelled ASW standoff weapon. We have had it since the sixties. It is very old and is being phased out. The ASW standoff weapon Sea Lance was initially started as a replacement for the SUBROC. Then we insured that as we were proceeding with that development——

Mr. DICKS. SUBROC was nuclear?

Admiral BACIOCCO. Yes, sir. It was, and always has been. Sea Lance replaces SUBROC. Two years after the Sea Lance IOC's, we will have a conventional capability.

Mr. DICKS. I have to question the judgment of not going with a conventional system first. There will be a serious political question about whether you can use nuclear weapons.

Admiral BACIOCCO. Had we done that based on the payloads available, we would have had to have used an obsolete torpedo. The pace of the MK-50 torpedo was such that it would not support the IOC of a standoff weapon necessary to replace the SUBROC.

Mr. PAISLEY. Let me say this. If we did not have a nuclear variant, the schedule we would have for bringing in the MK-50 would be just what it is today. With the nuclear variant put on there, which was really what it was replacing, you can bring that capability on early. If we could get the MK-50 tomorrow, we could put the MK-50 variant in ahead of the nuclear warhead. It just turned out we didn't have the MK-50 available——

Mr. DICKS. Why don't we accelerate the MK-50?

Mr. PAISLEY. I would like to. It is a much needed weapon. It is moving as fast as it can.

Mr. DICKS. The gentleman from Pennsylvania.

INITIAL TRAINER DEVELOPMENT

Mr. MCDADE. Thank you, Mr. Chairman.

The Navy is requesting $84.6 million for initial trainers for the A-6F, F-14D, and SH-60F programs.

This shows up as a new program for fiscal year 1987. However, the Navy has always planned to develop trainers for these aircraft. Where was this work programmed or budgeted before fiscal year 1987, and why was a separate program element established in the fiscal year 1987 budget?

Mr. RUMPF. Mr. McDade, you are correct, the reason for that was—we always had those trainers planned—for each of those platforms. They were previously planned inside the aircraft procurement account, the APN account.

There is a budget regulation proposal that we were hoping to submit to Congress, to say we would prefer to do those initial trainers in a procurement account simply because they were, for the most part, derivations of other trainers wherever possible in order to save money and to be common with other systems. We were then informed by our own budget people and the Office of the Secretary of Defense that we had to fund initial trainers out of R&D. Hence, we established this new R&D line. But in order to maintain that commonality, we put all the initial trainers under a single person in NAVAIR so that the commonality would be pursued. But it was in response to a regulation that we had to fund first element trainers out of R&D.

Mr. MCDADE. Is the regulation causing you a problem or is it just a new method of accounting?

Mr. **Rumpf**. It is an old method of accounting we were hoping to get away from. Now it is back into R&D.

Mr. **McDade**. Will surface ship and submarine trainers also be programmed and budgeted in the same way, and if not, why not?

Admiral **Baciocco**. Generally, yes, sir. They will not necessarily have a separate program element, but will be funded in the R&D development of the combat system.

Mr. **McDade**. These trainer programs are being managed by a single program office which has representatives in each of the weapons system program offices.

Especially in light of Navy's efforts to reduce their acquisition bureaucracy, why is it more efficient in this case to add another office to conduct this work?

Mr. **Rumpf**. Mr. McDade, just for the reason I gave you on commonality. For example, when we first started the T-45 program, they were starting with a clean sheet of paper on what the trainer would be. We said, "Wait, you have an F/A-18 trainer. All you have to do is modify that to make it fully compatible with the T-45." Hence they did that. It was an issue of commonality.

Mr. **McDade**. What percentage of commonality will the A-6F, F-14D, and SH-60F trainers have with existing trainers (e.g., F/A-18, SH-60B)? Provide separate answers for hardware and software.

[The information follows:]

No specific percentage-of-commonality goal has been established by Navy. The Secretary of the Navy has directed maximum commonality between F-14D, A-6F, and F/A-18 weapon systems. Navy's F-14D/A-6F trainer acquisition plans call for a single competitive contract for joint development of the F-14D/A-6F trainers and specify maximum commonality within and across weapon system suites. These two suites of F-14D/A-6F training devices will be designed to one common software architecture and will capitalize upon the common aircraft hardware and software systems. Navy's instructional system development process will define the final capabilities of each device and will determine the final degree of commonality. Additional efforts are underway to achieve trainer-peculiar commonality through use of common trainer design, hardware, components, software, cables, connectors, etc. The SH-60F trainer will maximize commonality with the SH-60B aircraft system and trainer.

Mr. **McDade**. Provide a funding profile for these trainers as included in the FY 1986 President's budget. State the account, program element, and amount of funding for all years available.

[The information follows:]

These trainers were budgeted in the Aircraft Procurement, Navy (APN) account under the parent weapon system programs in the FY 1986 President's budget. Program elements are not used in the APN budget. Funding for these trainers appeared in the FY 1987 column of the FY 1986 APN Committee Staff Procurement Backup Book as follows:

Weapon system program	Fiscal year 1987 column of fiscal year 1986 budget	Page	Line item
A-6E/F	[1] $61,460,000	11	15
F-14A/D	[2] 44,380,000	43	15
SH-60F	93,412,271	105	15

[1] Included $4,399,000 for A-6E training equipment.

[2] Included $2,040,000 for F-14A training equipment.

During formulation of the FY 1987 Navy budget, FY 1987 and FY 1988 funding was rephased to accommodate the first-article RDT&E funding requirements for these training systems.

SSN-21 ATTACK SUBMARINE

DETAIL DESIGN

Mr. **McDADE.** Let's look at the SSN-21.

For fiscal year 1986, Congress appropriated $29 million above the budget for the Navy to conduct a competitive detailed design for the SSN-21, and instructed the Navy to submit a reprogramming request for the $11 million of additional required funds when this funding becomes necessary later in the fiscal year. The committee is now advised that the Navy has reduced the scope of this work to a total of $29 million.

Is this information accurate?

Mr. **PAISLEY.** John Keane?

Mr. **KEANE.** No, that is not correct. That $29 million was authorized, but never appropriated with appropriations that will be utilized within the current program structure.

Mr. **McDADE.** What is the total amount that we are talking about?

Admiral **BACIOCCO.** The $29 million, sir, which has been proposed.

Mr. **DICKS.** I think the money was appropriated in fiscal year 1986.

Admiral **BACIOCCO.** But not authorized.

Mr. **DICKS.** That is not what he said.

Mr. **KEANE.** It was appropriated, but not authorized.

Mr. **DICKS.** That is a big difference in this committee.

FEASIBILITY OF A COST CAP

Mr. **McDADE.** What is your opinion of a cost cap on the SSN-21 R&D program?

Mr. **PAISLEY.** Do we think it is a good idea?

Mr. **McDADE.** Yes.

Mr. **PAISLEY.** Absolutely.

Mr. **McDADE.** You are going to do it?

Mr. **PAISLEY.** Absolutely.

By the way, this is not the best way to do procurement. We are recovering from a bad situation. You should always use a fixed price contract when you get a program to the point where you feel it will stand a cap. When you cap a cost-plus contract, you do to a contractor what you shouldn't do. You get all the best of a fixed price and he gets the worst.

But we will be able to do this one. We have capped the contract and now we have total visibility into his costing. We are going to do it this way or we are not going to do the program.

Mr. **DICKS.** I didn't quite understand. You say we proposed $29 million above the budget for the Navy on this to conduct a competitive design for the SSN-21. What is the status of that?

We appropriated the money and you are saying you are not going to spend it because it isn't authorized?

Admiral **Baciocco**. No, sir. We are working within the Navy and DOD to get it authorized. We have got to have the $29 million authorized. Whether or not the additional $11 million is going to be needed is not clear to me yet.

The Navy ship design account has adjusted their priorities to continue with the contract design of the SSN-21, which is ongoing competitively with two contractors today.

SSN-21 Combat System

PROGRAM CONCURRENCY

Mr. **McDade**. Let's talk about the SSN-21 combat system. Mr. Secretary, a year ago, the Navy planned to begin full-scale development of this combat system in September 1988. Despite major problems in the development of enabling technologies over the past year, the Navy now plans to award the full-scale development contract nine months earlier than planned a year ago.

Is it prudent to accelerate this program, given the technical setbacks in the SUBACS program?

Mr. **Keane**. As you may recall, we had a SUBACS A and a SUBACS B version of the combat system that was to go ultimately into the SSN-21.

The FSED for SUBACS would have begun in fiscal year 1986. The FSED for SUBACS was scheduled for September of 1988. We have subsequently rolled those two capabilities into one combat system and that is the reason for the start in January.

Mr. **McDade**. Will the IOC for the SSN-21 also be accelerated?

Mr. **Keane**. No, that will stay the same.

MANAGEMENT RESERVES

Mr. **McDade**. According to the Navy Program Office, the cost estimates for this program include management reserves ranging from 25 percent to 60 percent, including 40 percent for the full-scale development contract.

Isn't this degree of funding for "unknowns" a clear signal that the current program plan is not well understood and involves substantial risks to the SSN-21?

Mr. **Keane**. I am not aware of any management reserve of those kinds of figures.

Mr. **McDade**. You are not aware of a 25 percent or 40 percent reserve or 60 percent?

Mr. **Keane**. No, sir.

Mr. **Paisley**. I am not either. In fact, that is unheard of. Why don't we tell you what we have for reserve for the record.

Mr. **McDade**. Fine.

[The information follows:]

The Cost Estimating Relationships (CERs) for the SSN 21 Combat System were derived from similar major weapon systems development programs. There were major differences between the model and the SSN 21 combat system. The Navy recognized and budgeted for these differences. The program is well defined and the risks are well understood.

The reserves cited above are not program reserves. They are adjustments to the CERs needed to develop a properly priced program. This program is properly priced and contains no contingency at the project level. All resources have been allocated to the contractor and support agencies. The management changes will provide the strong leadership necessary to execute the program within the well defined cost profile.

UTILIZATION OF ADA

Mr. **McDade**. The development effort will require the writing or reconfiguration of over four million lines of software code. As such, it will surely represent one of the largest and most complex system software packages in the Department of Defense. DOD has a documented requirement that all major software packages will utilize the "Ada" higher-order programming language in order to standardize software and significantly reduce software support and maintenance costs.

Does the Navy plan to utilize Ada fully in the SSN-21 Combat System? If not, why not?

Mr. **Keane**. The estimated number of lines of code is no longer four million. At one point in time there was an estimate that there would be four million lines. But, it is now in the neighborhood of 1.5 million to 2 million.

Regarding the Ada language, we have strongly encouraged respondents in our RFP package to come back within Ada, but it is not a hard and fast requirement. The reason for that is we are concerned that the spinoff from the SUBACS basic software technology, which may be used on the SSN-21, would cause undue risk if we forced that.

Mr. **Paisley**. I suspect that we are likely to see an Ada proposal come in from the second-source contractor that we have brought on board. That is my feeling.

Mr. **Keane**. That is correct.

Admiral **Baciocco**. Ada is also put into the standards for the Enhanced Modular Signal Processor, which is a part of the SSN-21 Combat System.

ACQUISITION STRATEGY

Mr. **McDade**. Our S&I staff has advised the committee that the SSN-21 Combat System acquisition strategy may be flawed because significant differences exist in the combat systems required for the SSN-688 and the SSN-21, resulting in two separate development and production programs being conducted concurrently.

Is that accurate?

Mr. **Keane**. No, sir. The unique differences between SSN-21 Combat System and that of the 688 is the wide aperture array and the very large sphere in the front end of the SSN-21. Other than that, there are very minor differences within those programs.

Mr. **McDade**. Is the Navy going to develop a variant of the Fiscal Year 1989 Combat System for the SSN-688 class?

Mr. **Keane**. That decision will be made at the end of this Fiscal Year. One thing we would probably execute would be the wide aperture array onto the 688's.

Mr. **McDade**. Does the Fiscal Year 1987 budget include funds for development effort specific to the SSN-688s?

Admiral **Baciocco**. The Combat System yes, sir.

[CLERK'S NOTE.—In reviewing the transcript, Admiral Baciocco changed his remarks to read: "Yes, sir. The entire BSY-1 Combat System is being developed for the SSN-751 and later SSN-688 class ships."]

Mr. MCDADE. How much is in there?

Mr. KEANE. It is about $203 million, I believe, relevant to that.

Mr. MCDADE. You can amplify it for the record, if you need to. When would the Fiscal Year 1989 Combat System for the SSN-688 class have to be delivered to the shipyard and how does that date compare to the comparable date for the SSN-21?

Mr. KEANE. They are one year apart. The year for the SSN-21, I believe, is 1993, and the 688 happens to be a year ahead of that.

Mr. MCDADE. Please answer the following questions for the record.

Thank you, Mr. Chairman.

[CLERK'S NOTE.—Questions submitted by Mr. McDade and the answers thereto follow:]

PROGRAM CONCURRENCY

Question. The Navy currently plans to issue a request for contractor proposals for full-scale development in January 1987. However, this system will not even be approved to begin advanced development until six months before that date, in June 1986. How does the Navy justify such extreme concurrency?

Answer. The program was approved for advanced development as SUBACS B in 1984. The System Design Definition phase was briefed to OSD with SSN-21 in June 1985 and again on 12 March 1986. The program review in June 1986 is a DSARC I decision to proceed with the SSN-21 Combat System and to assess the status of the Combat System program with respect to meeting the SSN 21 ship schedule.

There is no concurrency of Advanced Development and Full Scale Development.

Question. In a November 1985 report, GAO stated the following: "We believe several factors have contributed to SUBACS problems. These include Navy decisions to . . . introduce new innovative technology into new construction attack submarines through a concurrent development and production program."

Isn't the pace of the development effort for this system driven in large part by the long lead requirements for the shipbuilding program?

Answer. No. The combat system development pace is driven primarily by the need to adequately test and integrate component elements of the combat system prior to delivery to the ship.

Question. According to Navy data, this will result in full-scale development beginning three months after initial procurement funds for these components (in FY88) become available. Is this data accurate?

Answer. Full Scale Development will commence in January 1988 after the two year system definition phase is completed. Upon award of the Full Scale Development contract, long lead material purchase orders will be issued to procure the tactical equipments that will be delivered to the SSN-21.

Question. Doesn't this sound like the same road we went down with SUBACS, which the GAO and both authorization committees so strongly criticized?

Answer. No. We have two years of System Design Definition followed by six years of Full Scale Engineering Development. The SSN-21 Combat System will use proven technology including Navy Standards and AN/BSY-1 components as appropriate.

TEST INTEGRATION

Question. Is it true that both the Naval Underwater Systems Center and the Operational Test and Evaluation Force have raised concerns about the Navy's ability to conduct adequate test and integration in time to deliver a mature, fully operational combat system to the SSN-21? How is the Navy addressing these concerns?

Answer. Concerns have been raised about the Navy's ability to conduct adequate tests and integration in time to deliver a fully operational combat system to the SSN-21. The Navy assisted by both competing combat system engineering agent contractors is working to define a set of system requirements which will support SSN-21. As a part of system design development each contractor will provide the Navy a detailed risk assessment on their development, test, and integration approach for delivering a mature, fully operational combat system which meets these requirements.

BASELINE ARCHITECTURE

Question. According to the Navy, when the SUBACS program was restructured, the BSY-1 (SUBACS) combat system became the baseline for the SSN-21 1989 Combat System. In addition, the top level requirements for the SSN-21 Combat System were to be similar to those originally established for SUBACS A and B. Is the BSY-1 combat system still the baseline for the FY89 Combat System?

Answer. The AN/BSY-1 equipments and/or subsystems will be available for use in the FY-89 Combat System as appropriate. The equipment and software architecture is not constrained to that of the BSY-1, and there will be some new equipments developed to accommodate the new arrays.

[CLERK'S NOTE.—End of questions submitted by Mr. McDade.]

E-6A

Mr. PAISLEY. You asked a question, Mr. Congressman, earlier. The date of the critical design review for the E-6A was 11 July 1985, and a memo accepting that critical design review was the 23rd of August 1985.

Mr. McDADE. Thank you.

Mr. DICKS. Are we under contract now? Do we have a contract for the first two aircraft?

Mr. PAISLEY. I would say we were. However, I couldn't say for sure.

Mr. WANG. We currently are under contract for the R&D aircraft and we are in the final stages of negotiation for the first two production aircraft and it is awaiting congressional notification.

Mr. DICKS. The procurement contract has been signed?

Mr. WANG. No. The first FSED contract.

Mr. DICKS. A memorandum was signed by Secretaries Lehman and Taft that I have seen that lays out the negotiated——

Mr. PAISLEY. Hubert, could you repeat what you said about the two procurement aircraft.

Mr. WANG. The two procurement aircraft contract negotiations just have been completed, and we are in the process of notifying Congress before we award the contract.

Mr. DICKS. Is there any requirement to notify the Congress or is this just a courtesy?

Mr. WANG. A courtesy.

Mr. DICKS. There is a memorandum from the Chief of Operations and one from Secretary Lehman to Secretary Taft, "We have reached agreement with the Boeing Airplane Company on an E-6A procurement program at a not-to-exceed price of $1.478 billion," and it goes through a letter.

[The letters follow:]

Status

DEPARTMENT OF THE NAVY
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20350-1000

3 February 1986

MEMORANDUM FOR ~~THE DEPUTY~~ Will SECRETARY OF DEFENSE

Subj: TACAMO MODERNIZATION PROGRAM - INFORMATION MEMORANDUM

We have reached agreement with the Boeing Airplane Company on an E-6A procurement program at a not-to-exceed price of $1,478.9M. The aircraft unit price in this program is $62.0M per aircraft, about $3.7M per aircraft less than Boeing's original not-to-exceed proposal. This acquisition program procures aircraft on a 2,3,3,6 basis starting in FY-86. Aircraft will deliver on a schedule consistent with the procurement profile contained in PBD 113C. The funds provided by PBD 113C are sufficient to execute this program.

In addition to achieving lower aircraft procurement prices, we have reduced production support costs by $50M and are working with the Air Force on common training support and joint support basing to further reduce operating costs. Don Latham recently wrote the Air Force asking that they support our requirements and I would welcome your support as well.

On 24 January 1986, we released $40M of FY-86 pre-production funds to protect Boeing's not-to-exceed offer. We plan to finalize the acquisition strategy and release production and advanced acquisition funds through a letter contract to Boeing no later than the first week in February 1986.

Joh

John Lehman
Secretary of the Navy

DEPARTMENT OF THE NAVY
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20350-1000

10 January 1986

MEMORANDUM FOR THE DEPUTY SECRETARY OF DEFENSE

Subj: TACAMO MODERNIZATION PROGRAM - INFORMATION MEMORANDUM

Program Budget Decision 113C directed that we implement an E-6A procurement program of two aircraft in FY-86 and three aircraft per year, FY-1987 through FY-1990.

In anticipation of Congressional approval of the E-6A program, we have been conducting contract negotiations with Boeing in order to execute FY-1986 procurement at the earliest possible date. Your most recent decision on E-6A procurement rates is somewhat different from our original decision to buy two aircraft per year over seven years. However, we plan to reopen negotiations with Boeing on the new procurement profile and have these negotiations completed at an early date.

In your 23 October 1985 letter you asked for data necessary for the Director, Operation, Testing & Evaluation to use in his report to Congress. These data were provided to the satisfaction of his staff.

In summary, we are proceeding to reach agreement with Boeing on production prices for the E-6A program and will report the results to you within 30 days.

John Lehman
Secretary of the Navy

5501255 2

THE DEPUTY SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

23 OCT 1985

MEMORANDUM FOR THE SECRETARY OF THE NAVY John;

SUBJECT: TACAMO Modernization Program (U)

In order that the Department can comply with (deleted)

the Congressional directive whereby the Secretary of Defense must submit a plan to Congress so that they can be assured of continuity of funding for the E-6A program, I hope that you will submit by November 15, 1985, the following two plans:

a. (U) A plan which lays out the steps needed to obtain production approval for the E-6A by the end of the first quarter FY86, and

b. (U) A plan which can be forwarded to the Congress by the Secretary of Defense which demonstrates assured funding continuity for the E-6A program.

(U)Since this is a major program under Title 10, U.S. Code, the Director Operational Test and Evaluation (DOT&E) is required to submit a report to the Secretary of Defense and to the Appropriations and Armed Services Committees of the Senate and the House of Representatives concerning the adequacy of the operational test and evaluation conducted on this system and whether those results confirm that the system is effective and ready for combat. This report must be received by these four committees of Congres prior to a final production decision being made on the system. DOT&E believes this assessment can be completed prior to the need for a production decision. In order to accomplish this, DOT&E will need to receive all requested data from the various tests, evaluations and analyses in an expeditious manner.

Will

William H. Taft, IV

Classified by ASD(C^3I)
Declassify on OADR

John, I hope you can meet these schedules.

Will

5501255:

SEC DEF CONTR No. X37089

Mr. DICKS. So I assume that has been done.

Mr. PAISLEY. It sounds like it hasn't, so I owe you a response on that.

In fact, Mr. Congressman, I will check that and call your office.

[The information follows:]

On 7 March 1986, the Navy signed a contract modification exercising the FY 1986 production option from the 29 April 1983 letter contract with Boeing. The value of this contract modification was $20M. Congressional notification took place on 13 March 1986.

MARINE CORPS RDT&E

RATE OF FUNDING GROWTH

Mr. MCDADE. Let me ask a couple of questions.

General Franklin, for fiscal year 1987, the Marine Corps is requesting $287 million in R&D funding, which represents a 46 percent increase over the fiscal year 1986 level adjusted for Gramm-Rudman-Hollings. It seems like a very high degree of increase, particularly when we are considering Gramm-Rudman-Hollings.

Why is a 46 percent increase necessary?

General FRANKLIN. That is an apparent increase because of the LVT-X cancellation last year when we gave back $28.8 million.

In the 1987 budget, we took the $63.2 million that was in LVT-X and reprogrammed it into underfunded programs, like, for instance, the product improvement of the AAV7A-1. We beefed up that product improvement.

Also, we put money into mine warfare for the surface mines which was a critically underfunded program for years, primarily fuel air explosive in tractor to blow up a mine-cleared lane. We also reprogrammed the Dragon PIP.

So we took the LVT-X money that was in 1987, reprogrammed it out and with the big reduction in 1986 it looks like a tremendous growth, but if you saw 1986 with the LVT-X in it, it would have been a smooth ramp.

Mr. MCDADE. Last year, General, Marine Corps documents showed a funding level of $226 million for fiscal year 1985. This year that figure has decreased significantly to $201 million.

For the record, would you verify the accuracy of these numbers and explain the cause of the decreased funding requirement and what happened to these extra funds.

General FRANKLIN. I know there was a reduction. Primarily it had to do with the LVT-X cancellation. The other specifics I will supply for the record.

[The information follows:]

The January 1985 President's Budget contained a request for $225.5 million in Marine Corps RDT&E. The final allocation in FY85 was $201 million. The $24.5 million reduction was primarily due to the cancellation of the LVT-X program. Specifically, $21.7 million from LVT-X was provided to the Navy who utilized the funds primarily for support of Marine Corps aviation interest projects. An additional $2.8 million was provided for additional Marine Corps aviation interest programs such as the AH-1 helicopter, bomb fuzes, the A-6E and aircraft engine component improvement programs (CIPs). This $2.8 million was recouped from several joint service programs which were unable to completely expend budget funds in FY 1985.

MARINE CORPS TEST AND EVALUATION SUPPORT

Mr. McDade. General Franklin, also, the 1987 budget for the Marine Corps includes $14.5 million to fund R&D activities at Quantico and at Camp Pendleton, including the Marine Corps Operational Test and Evaluation Activity. This looks like an increase of 30 percent over the 1986 level of $11.1 million.

Tell us if that is that much of an increase and tell us why you need it.

General Franklin. From the piece of paper that we sent over on our support activities, the significant increase was for an organization called MCTSSA. It went from $4.2 million in FY-86 to $7.4 million in FY-87. That is the Marine Corps Tactical System Software Support Activity on the West Coast and the primary reason for the increase is because we now have TAOM on the hill at Camp Pendleton undergoing tests and MIFASS arrives at Camp Pendleton in May.

So those two major software intensive systems will undergo a lot of testing and that is the reason for increased cost for MCTSSA this year.

EMPRESS II

Mr. McDade. Mr. Secretary, the Navy is continuing the development of the electromagnetic pulse radiation environment for ships (EMPRESS II) in fiscal year 1987. This will involve barge-mounted electronics which measure shipboard resistance to EMP effects. The program has caused some controversy due to the planned operation of EMPRESS II in the Chesapeake Bay.

What is EMPRESS II, and what are its potential environmental implications?

Mr. Paisley. Dick Metrey, why don't you discuss this?

Mr. Metrey. EMPRESS II is a device for testing ships relative to their nuclear hardness. It is not unique in the services. The Air Force has a site in Albuquerque, New Mexico, for testing their aircraft. The Navy has had what we call EMPRESS I in the Chesapeake Bay in the Solomon Island area for testing our ships.

EMPRESS II is a larger facility to measure higher pulses, which was deemed necessary by the increase in the threat. The issue has been the environmental effect of the large electromagnetic pulse. There is a draft environmental impact statement which has been circulated to the states in the Chesapeake Bay area.

We have received comments back. At the same time, we are conducting studies relative to the environmental impact of this device, both on the marine life in the bay and relative to the electronic systems and machinery that would be on fishing vessels and commercial vessels which is outside of the two-mile restricted area of this device, where it is going to be located.

The schedule we have is to submit a supplemental draft impact statement later this year.

Admiral Baciocco. September 1986.

Mr. Metrey. We will hold public hearings in December of 1986 and the final environmental impact statement will be filed in February of 1987.

The studies that we have had to date—we have had a short-term effects study on marine life by the University of Maryland—show that there is no adverse effect.

We, however, do have a long-term effects study in process.

Mr. **McDade**. We are informed that the Governor of Virginia—and by the way, Congressman Dyson is very much interested in this program as well—the Governor of Virginia has advised the Navy that he is "strongly opposed to implementation of this project" until certain technical studies are completed and reviewed by affected state and local governments.

What is the status of these studies?

Mr. **Metrey**. I don't know what the state study status is.

Mr. **McDade**. And local governments, too.

Mr. **Metrey**. We do have the draft environmental impact statement which has been circulated. We are making available the results of the University of Maryland studies which are being conducted. We have studies being done by Naval Surface Weapons Center at White Oak on the effect of the air pulse on electronic equipment. That will be made available.

So I think it is a matter now of pulling this together.

Mr. **McDade**. Is Bloodsworth Island still the planned operational site for EMPRESS II?

Mr. **Metrey**. Yes, sir.

Mr. **McDade**. Why do you have to do this in Chesapeake Bay? Why not someplace else?

Mr. **Metrey**. There are a number of factors. You have to do it in a place where you can reasonably control the environment. There is an alternate site that has been offered off the Virginia capes, off North Carolina.

Mr. **McDade**. Is there a specific site there you can mention?

Mr. **Metrey**. Yes, sir. There is an area there that we could use, but the problem is that we would have more downtime due to the weather because it is a less controlled area than in the bay where the sea conditions are more favorable. We do have in the bay a gunnery site which is a restricted area, and it would accommodate the two-mile range requirement.

Mr. **McDade**. How long have you been operating at that facility?

Mr. **Metrey**. I don't have the exact time. We have had the EMPRESS I facility, I would say for perhaps 10 years, but I will give you an exact number.

[The information follows:]

EMPRESS I has been in operation for 13 years. Initial Operational Capability was achieved in 1973.

Mr. **Paisley**. Would you like us to expand a little on the EPA issue? I could have Nancy Stehle talk a little more about it.

Mr. **Stehle**. The draft environmental impact statement was circulated. We had a number of comments and we certainly had a lot of interest primarily from the State of Maryland and some interest from Virginia and North Carolina.

We met with all those people and arranged to do continuing studies. We determined that it would be best if we did a supplemental environmental impact statement in order to address a number of these additional concerns that were brought up.

One of the aspects of an environmental impact statement is to look at all the environmental impact to the sites that we have been looking at.

We have not selected the Chesapeake Bay as a final site. That would not be done until we are done with the whole environmental impact process. At the time we complete the environmental impact statement process, the whole NEPA process, the Secretary will make a decision as to where we are going to go and it is conceivable that he may decide that the Chesapeake requires additional studies and we don't even go there at that time.

Mr. McDADE. What is your best judgment about whether and when that will occur?

Mr. STEHLE. I was under the impression that the first draft environmental impact statement will be done some time this summer, but the supplemental will not be done until 1987——

Admiral BACIOCCO. The first draft will be done about September 1986.

Mr. STEHLE. The decision will not be made until February 1987.

Admiral BACIOCCO. Our current plan is to file the final environmental impact statement in February 1987.

Mr. McDADE. Thank you, Mr. Chairman.

WHITEHALL QUICK REACTION SURVEILLANCE SYSTEM

Mr. DICKS. Mr. Secretary, the Congress appropriated $20 million in fiscal year 1986 Navy R&D funds for the Whitehall Quick Reaction Surveillance System. Those funds are for the first year of a three-year lease, on a turnkey basis, of four systems together with vessels and crews.

What is the status of this effort?

Mr. KEANE. We have worked a schedule that is consistant with the requirement to go competitive with the contract. That requires that we go to industry with an industry briefing and then an RFP and then responses to those proposals.

We currently are shooting for, a schedule that gets us under contract by 30 September.

Mr. DICKS. Is this going to be a lease?

Mr. KEANE. This will be a lease with options—it will be a lease of the first system with options for multiple systems.

Mr. DICKS. But you are going to compete it?

Mr. KEANE. We will and we are trying to accelerate the schedule. It looks like we may be under contract by as early as July.

Mr. DICKS. And that will use the $20 million that we have provided in 1986.

Is this in the 1987 budget?

Mr. KEANE. It is not in the 1987 budget.

NAVY TECHNOLOGY APPLICABLE TO SDI

Mr. DICKS. Mr. Secretary, you note the Navy's support for the President's stretegic defense initiative. Would you describe what work you are doing that relates to the SDI and how you view this program?

Mr. **Paisley**. First, let me start off, then Admiral Baciocco will provide details about what we are specifically doing. But first let me give you my personal view of the program itself.

I am glad to say that it has one of the better program managers in the government, Gen. Abrahamson. I am talking about the SDI itself. I am glad to say we have a really first-class officer who has a lot of experience running that program.

We offered our expertise to participate in various areas of that program, and particularly in areas where we were already working. The battle management work that has been done in the AEGIS system is probably the most extensive that has been done in the government. It has direct application to that program.

The laser work that we are doing also has direct application. We have just drawn up an agreement to take over a portion of some work that is going on in that area.

Mr. **Dicks**. That is the high-energy laser program?

Mr. **Paisley**. Yes.

Mr. **Dicks**. Where is that work being done?

Mr. **Paisley**. White Sands.

Admiral **Baciocco**. Mr. Chairman, that, is not a development program. As you will recall, the Navy had a high-energy laser program called MIRACL, the Mid Infrared Advanced Chemical Laser, which was under technology development for some years, with the idea of using that as a shipboard defense system.

We shifted management of that program to DARPA just before SDI was initiated, and with the formation of SDI they took over that laser at White Sands and asked us to run it for them as a test device to look at laser damage to missiles and the like.

That is part of our support for SDI. We also have in the Fiscal Year 1987 budget, some $330 million of SDI funds that are under Navy management. They include the directed energy work with the MIRACL laser, a major program in optical discrimination, laser discrimination, and discriminating very small targets against a very cluttered background in space.

We also have a significant amount of work in support of General Abrahamson in battle management C3 and other smaller efforts.

Mr. **Dicks**. What are you doing on battle management C3 and where it is being done?

Admiral **Baciocco**. This work is not in a major central location. What we are trying to do is to give the expertise and experience of the AEGIS system development to the SDI program.

Mr. **Dicks**. The reason I am asking this is I am going to make a trip to look at some of these things. I am trying to understand what the Navy's role in this is and where you would go to get the best feeling for what you are doing on the SDI program.

Admiral **Baciocco**. Mr. Chairman, we have a program that is on the West Coast that I see no reason why we shouldn't get you cleared on, it is a codeword program. It is on the West Coast in California. It could make a major improvement in our capability in this area.

You should definitely go look at it.

Mr. **Dicks**. I don't have anything further.

Mr. **McDade**. Well done.

Mr. DICKS. Thank you, Mr. Paisley, and your supporting witnesses. We appreciate it. You have done a very good job.

Mr. PAISLEY. Thank you, Mr. Chairman.

Mr. McDADE. Mr. Chairman, Mr. Young and Mr. Livingston have some questions they would like answered for the record.

SOVIET SUBMARINE TECHNOLOGY

Mr. DICKS. Without objection.

[CLERK'S NOTE.—Questions submitted by Mr. Young and the answers thereto follow:]

Question. Secretary Paisley, last year you and I had a discussion about the advancing Soviet technology in their submarines. You made the point that the Soviets are improving on their submarine ——— techniques, and that in some technologies, the Soviets are ahead of the U.S. It is disturbing to this member when the Soviets are ahead of us in anything, but it is particularly disturbing when they are ahead of us in submarine technology where their numerical advantage is also so superior. What is the current status of their technology advantage?

Are we providing the funds necessary for you to do what you must to solve this problem?

Answer. The U.S. attack submarine force is outnumbered by the Soviets by a ratio of nearly three to one. The U.S. superiority against these odds has been sustained through the technological superiority of our submarines and the superb professional skills of our submarine crews. During the past decade however, the Soviets have sought to erase the U.S. margin of technological superiority through the application of research and development on a grand scale. The new Soviet submarines are by no means small and inexpensive. . . . they are large submarines built for a broad technological base. In some areas Soviet submarine construction is estimated to challenge the U.S. in applied technology. These areas include: ———.

Question. Secretary Paisley, shortly after the Walker spy incident year, this committee was told that as a result of what the Walkers had revealed to the Soviets, they changed their methods of operating in the Atlantic.

Has the Navy been able to determine if any of the information the Walkers provided gave the Soviets any technology that they did not have previously?

Answer. We have been advised by the prosecuting Assistant U.S. Attorney assigned to the Jerry Whitworth espionage trial that completion of the damage assessment should be held in abeyance until the conclusion of the Whitworth trial. At that time, in accordance with the October 1985 plea arrangement with John Walker, Jr., we will be able to question Walker in more detail regarding Soviet technology gains and verify his responses with polygraph examination.

V-22

Question. Secretary Paisley, your prepared statement is rather complimentary of the cost savings you are achieving on the V-22 among other systems. In fact you are citing a $125 million savings in develoment costs for that program.

With those costs savings are there any reductions in the missions the V-22 will perform?

Answer. No, There are on reductions in the specified missions that this aircraft is designed to meet. The cost savings was realized through reevaluation of each requirement and scrubbing of those requirements to be minimum acceptable level to meet the stated mission capability.

Question. Among the missions that have been identified for the V-22 are the Marine Corps Assault Mission and the Navy Search and Rescue mission.

Are there other missions the V-22 can perform?

Answer. In addition to the specified missions above it is our position that the V-22 will provide: For the USMC, Visual Reconnaissance, Forward Air Control/Tactical Air Control (Airborne) MEDEVAC and Aerial Refueling capabilities; for the Army, Logistic Resupply (inter-theater), MEDEVAC, Air Assault, Reconnaissance Insertion/Extraction and Special Operations; for the USAF, Special Operations (Long Range), Combat Rescue, MEDEVAC and Aerial Refueling; for the Navy, Vertical/Carrier On-Board Delivery, Aerial Refueling, and for specialized operations in Anti-Submarine Warfare which is mission unique. The Navy has developed a Tentative Operational Requirement for an ASW variant of V-22 to support FY-88 start in this mission area. The Navy continues to evaluate other mission application including SIGINT and AEW.

Question. The Army now has attempted to define the LHX more clearly than it had the last time we discussed these issues.

Does the LHX with the speed and weight constraints the Army has put on it have any place in the Navy or Marine Corps aircraft inventory?

Answer. Upon completion of a successful U.S. Army R&D phase it is our intention to reexamine the demonstrated potential of the LHX to see what areas this viable aircraft could meet.

AEGIS SECOND SOURCING

Question. Secretary Paisley, your prepared statement says that you are "actively pursuing second sourcing the AEGIS integration effort". In FY '85, Congress appropriated $83 million to develop a second source for the AEGIS weapons system. In FY '86, a provision in the final Appropriations Joint Resolution required that . . . "the Secretary of the Navy shall select a second source, by the most expeditious means available, for the CG-47 and DDG-51 SPY-1 radar, AEGIS production test center, shipyard and shipboard combat system integration . . . in order to begin competition between the current contractors and the second source contractors in fiscal year 1988. . . ."

During the FY '86 hearings, the Navy testified that the second source award for the SPY-1 radar would be imminent. A year later the RFP for the SPY-1 antenna has still not been released.

How do you explain the inordinate delay on this particular AEGIS component?

Answer. The SPY-1 Radar is a subsystem component of the AEGIS Weapon System (AWS). AEGIS competition includes all major components of the AWS, and in fact, we did select second source contractors in FY85 for the first two AWS components. The SPY-1 competition selection process commenced shortly thereafter and we issued the RFP for the SPY-1B transmitter in November. Note, the SPY-1B is not being competed as an entity, but as individual competitions for the three major components: Transmitter, antenna array and signal processor. The schedule is as follows:

Issued SPY-1B transmitter RFP: November 1985.
Issue SPY-1B antenna RFP: 2 April 1986.
Receive SPY-1B transmitter proposals: 4 April 1986.
Select SPY-1B transmitter second source: July 1986.
Receive SPY-1B antenna proposals: August 1986.
Select SPY-1B antenna second source: November 1986.
Issue SPY-1B signal processor RFP: FY87.

The original schedule was predicated on concurrent second source evaluations. We in fact attempted concurrent second source evaluations but where unable to maintain schedules due to limited personnel resources i.e., many of the same people were required for both evaluations. For the SPY-1B transmitter and antenna, we will again need most of the same people to evaluate those proposals. We have now staggered the evaluation process to use our people more efficiently. The SPY-1B signal processor competition will be conducted in FY87 according to the original plan. Note, we also experienced some delays by adding the requirement to have offerors capitalize their tooling and test equipment and thereby reduce our funding needs.

Question. Is the Navy using the "most expeditious means available" to select a second source of the SPY-1 antenna?

Answer. The "most expeditious means" would be a directed second source which we are not doing. There has been widespread industry interest in the SPY-1 competitions and, in fact, many of the companies commenced work on their proposals prior to receipt of the RFP. A directed second source in this case would negate efforts to obtain the best qualified company for an AEGIS second source. We are using the fastest means available which are consistent with good business practice and Federal Acquisition Regulations.

Question. When will the SPY-1 second source be selected?

Answer. In July and November of 1986 for the transmitter and antenna respectively.

Question. What is the current status in the selection of a second source of AEGIS Integration, including the production test center, and shipyard and shipboard combat system integration?

Answer. The Navy commenced work on both of these newly directed tasks immediately upon receipt of the FY86 Congressional language. There is a parallel effort going on in both areas: Production Test Center (PTC): The contractual process commenced in January. Requests for proposals and contract authorizing papers are being drawn up. In the meantime, the Navy has had a series of planning meetings with Sperry Corp. The purpose of the meetings is to define the implementation process and to generate an RFP for the work scope. These meetings have been very productive and are continuing. Shipyard Testing: Once again, contractual converage is in process. In advance of this coverage, the Navy has commenced training Sperry engineers at the AEGIS Education Center. The First Sperry students commenced class on 17 March 1986. Others will join classes as they commence between now and July, 1986. These Sperry people will join the AEGIS Shipyard Test Team for qualification.

Question. Does the Navy plan to abide by the legislation and compete the AEGIS systems in the fiscal year 1988 budget request between the current and second sources?

Answer. Yes, where appropriate.

Question. Are you working on second source selection expeditiously enough to achieve that milestone?

Answer. Yes, with the exception of the SPY-1B signal processor. That second source selection has always been planned for FY87 because the signal processor is still in development. However, full competition so soon after second source selection may not be achievable.

[CLERK'S NOTE.—End of questions submitted by Mr. Young.]

NAVAL BIODYNAMICS LABORATORY STATUS

[CLERK'S NOTE.—Questions submitted by Mr. Livingston and the answers thereto follow:]

Question. Secretary Paisley, Admiral Baciocco, the Defense conferees last year provided $12.719 million for the Medical Development (Advanced) account. this amount represented an 18% increase over the FY 1985 levels. The conferees also directed in their report that the Navy allocate no less than $2,350,000 for the air crew impact injury prevention program currently housed at the Naval Biodynamics Lab in New Orleans. Yet, your fiscal year 1986 budget justifications indicate that the impact injury program will only be funded at $2,170,000 for FY 1986. Is this accurate?

Answer. The program will be funded at a level of $2,174,000 as noted in the Budget Justification Material provided to Congress.

Question. This committee has been concerned about this program since FY1984 when it directed the Navy to allocate no less than $2.86 million for the impact injury program. We directed that you fund it at no less than $2.35 million in FY1986, well below the FY1984 and FY1985 levels. Why is this program being slowly starved?

Answer. This program is not being slowly reduced. As noted in the Budget Justification Material provided to Congress, the resources for this program are increasing.

Question. Isn't the Navy ignoring a congressional directive?

Answer. Although the Manager's Report accompanying the continuing resolution on Fiscal Year 1986 Appropriations indicated that the Navy was to allocate no less than $2.35 million, this effort as well as the other projects in PE63706N were impacted by congressionally required reductions for Contractor Support Services and Inflation adjustments.

Question. In testifying about the Naval Biodynamics Lab, where this research is conducted, last year the Navy said the following . . . . "This combination of facilities, experience, and personnel make this research effort truly unique." In the department's appeal letter to this subcommittee before our conference last year, the Navy stated that. . . . "Termination of their work will have several far reaching ramifications on the Navy's ability to develop systems, procedures, and design guidelines that will reduce injuries during emergency egress and impacts. . ." I understand that the Navy is increasing funding for other programs within the medical development (advanced) account by approximately 50% to 60% more (i.e, health technology, protective clothing). Does the Navy consider the impact injury program a low priority program?

Answer. The Navy considers the Impact Injury Program to be an important effort as reflected by the resources provided as noted in the Budget Justification material provided to Congress. The Navy intends to continue this important program.

Question. Provide for the record a breakdown in funding for fiscal years 1985, 1986, and estimates for FY1987 for the Navy Biodynamics Lab in New Orleans identical to the one provided in last year's hearing record. Also include an updated breakdown of occupied civilian and military positions at the Lab identical to the one in last year's hearing record. Provide an identical funding breakdown for all other programs within the medical development (advanced) account. Include in these breakdowns in the impact of the FY1986 Gramm-Rudman-Hollings sequester.

Answer.

FUNDING FOR NAVAL BIODYNAMICS LABORATORY

[In thousands of dollars]

Thrust area	Fiscal year—		
	1985	1986	1987
Ship motion (6.2)	$503	$491	$491
Ship vibration (6.3)	326	311	342
Impact injury (6.3)	2,589	[2] 2,174	[1] 2,622

[1] Beginning in fiscal year 1987, funding support will be provided under PE63216N, project MOO97 (this figure not included in PE633706N total).

[2] Dose not include Gramm-Rudman sequester.

a. Occupied military officer billets	8
b. Occupied military enlisted billets	7
c. Occupied military research volunteer billets	23
d. Occupied civilian positions	41
Total personnel	79

[In thousands of dollars]

Thrust area	Fiscal year—		
	1985	1986	1987
Blood and Blood Substitutes	$1,589	$2,054	$2,483
Wounds Shock and Sepsis	1,154	1,365	1,966
Hemopoietic Stem Cells	1,652	1,334	3,400
Care of Casualties in Extreme Environments	215	575	1,450
Combat Medical Material	989	2,070	2,981
Dental Materials and Procedures	310	342	865
Personnel Selection	1,541	1,182	2,247

Thrust area	Fiscal year—		
	1985	1986	1987
Physical Readiness	425	475	966

¹ After Gramm-Rudman sequester.

Fiscal year 1986 Gramm-Rudman sequester for 63706N

Thrust area	*Thousand*
Hemopoietic stem cells	$176
Care of Casualties in Extreme Environment	200
Combat medical material	70
Personnel selection	84
Physical readiness	30
Impact injury	119
Total	679

SKIPPER/PRACTICE BOMB

Question. This Subcommittee appropriated $10 million in additional, authorized funds last year for improvements in various bomb programs including the development of a low cost companion practice bomb.

How is this program progressing?

Answer. The low cost companion practice bomb program is progressing well.

Question. Provide for the record a detailed status report on this program for FY1986 as well as the Navy's plans for FY1987.

Answer. Naval Weapons Center (NWC), China Lake, CA has been tasked and funded to develop a Laser Guided Training Round (LGTR) to provide a low-cost training device as an alternative to the use of live Paveway II and Skipper II (AGM-123A) weapons. The program goal is to deliver LGTR to the fleet in FY89 at a project cost of $400. and $2400. respectively for unpowered and powered LGTR. Commercial development practices and parts will be used to meet this challenging cost/schedule goal.

Three other bomb improvement projects as recommended by your committee are also underway:

Inertially Aided Munitions—Naval Air Systems Command provided funding to the USAF and will provide funding to NWC to begin joint development of a low-cost inertial platform to be used in conjunction with MK80 series bombs, SKIPPER type munitions and/or cluster munitions to improve accuracy and hence effectiveness of these weapons.

SKIPPER improvements and Cluster Munitions—The use of the NWC developed low cost seeker technology to use with SKIPPER type munitions is to be investigated at NWC. Funding for this and the evaluation of submunitions for use in a cluster weapon is being sent to NWC.

In FY1987 we plan to continue technical demonstration and evaluation of submunitions and initiate evaluation, selection and development of a delivery vehicle for an interdiction weapon.

[CLERK'S NOTE.—End of the questions submitted by Mr. Livingston.]

Mr. DICKS. Please answer the rest of the committee questions for the record.

[CLERK'S NOTE.—Questions submitted for the record and the answers thereto follow:]

BSY-1 COMBAT SYSTEM

MANAGEMENT IMPROVEMENT

Question. In 1985, the Submarine Advanced Combat System, now renamed BSY-1, encounted severe development problems. Navy and GAO assessments indicated that a major cause of these prolems was weak program management. The Navy has now restructured the program to address these problems.

Please explain what management improvements have been implemented in this program.

Answer. Projectizing the program office was done to improve control. Similar organizations have been established at the prime contractor and Navy laboratory. In addition to projectizing, individual changes were made in key positions at the major organizations. A Flag Officer was placed in charge and the chief engineer replaced at NAVSEA. The Commanding Officer of the Naval Underwater Systems Center has refocused the laboratory effort and replaced the head of the Combat Control Systems Department. Lines of communication and authority have been definitized. The prime contractor has responded in the management area by reducing matrixing and providing clear lines of responsibility. Two senior managers were replaced (the Manassas site manager and the AN/BSY-1 program manager). The next level of accountability was also strengthened.

Question. Poor monitoring of cost, schedule, and technical progress was cited as a major problem. What specific changes have been made in this area?

Answer. A set of programmatic tools have been put in place to measure program progress. A review of program master schedules was conducted. Over 500 milestones were selected to measure progress towards system delivery to SSN 751. Any milestone that is missed is reviewed for cause, program impact and recovery measures. For cost control, the Navy has modified the development contract to provide a cost ceiling, with no liability for cost growth above that ceiling, as directed by the Authorization Conference report. Liquidated damages for late delivery of equipment and failure to meet performance criteria were negotiated as part of the modification. The change control process has been revised to provide a more disciplined approach. Changes affecting cost and schedule must be approved by the NAVSEA Program Director, Submarine Combat Systems. The program master schedules were revised to reflect the Replan. Detailed plans and schedules are in place for software development, hardware development, and system integration and test, and progress against these plans is being measured continuously.

Question. These reports stated that the advice of the Navy's lead laboratory had been consistently underutilized. By what specific actions has this role been strengthened?

Answer. The program office has reconfirmed the role of the lead laboratory as the technical direction agent. An on site team of NUSC personnel is in place to provide the necessary insight to progress on the contract. When the program office was projectized NUSC organized along project lines to more directly support AN/BSY-1. The NUSC program manager has direct access to PMS-417. Regular program reviews with NUSC are being held to monitor their progress, to review issues and to review progress of the contract. Monthly progress reports have been improved to document progress and issues. The TDA has direct access to the Program Director.

Question. As part of the recently signed BSY-1 contract mod, Navy and contractor officials agreed to limit the lab's role in program monitoring, and agreed that the lab will have no visibility at subcontractor facilities.

Why did the Navy actively agree to limit the lab's access to all data needed to monitor this program?

Answer. The Navy did not agree to limit the Laboratory's access to data needed to monitor the program. In fact the laboratory role in review and approval of program documentation (specifications, contract data requirements and test procedures) has been increased to include total coordination of review and comment generation. Laboratory personnel were integrated into the program office teams that developed the contract modification. Access to subcontractor facilities has been formalized, not reduced. The contract mod does not contain language that limits the lab's role in this program.

Question. What percentage of BSY-1 prime contracts will be subcontracted?

Answer. Approximately 46% of the IBM prime contract has been subcontracted to major subcontractors (Raytheon, Hughes Aircraft, Rockwell).

Question. Recent technical assessments indicated that certain subcontractor-produced hardware modules are high risk and are behind schedule. Given the amount of risk in these subcontracts and little schedule flexibility, how does the Navy justify not having its Technical Direction Agent at major subcontractor facilities?

Answer. The Technical Direction Agent has the necessary access to the subcontractor facilities to monitor these modules. The technical risks for this hardware has been reduced and they are being produced in sufficient quantity to support system integration.

Question. Please provide a current organization chart of the BSY-1 program office, and provide number of staff in each section of that office. If any section managers are in an acting or double-hatted capacity, please indicate this. Provide the number of staff-years planned for NUSC support, and explain NUSC's responsibilities for the program. Compare all of this data to the organizational structure, numbers of staff, and responsibilities immediately prior to the restructure.

Answer. Figure 1 through Figure 4 (see attached) show the organizational chart for NAVSEA 06V, Submarine Combat Systems. The shaded blocks show billets planned but not available bacause of reasons discussed below.

Many management changes have been made in the NAVSEA program office, the laboratories and in the contractor's organization. At NAVSEA and NUSC, the program offices have been reorganized from a matrix sturucture to a dedicated projectized organization. Comparing the previous organization with the current organization is not realistic because of the part-time and fragmentized division of responsibilities in the original matrix organization. Within NAVSEA, a ceiling cut directed by higher authority resulted in a reduction in the ceiling (civilian) resources applied to SSN combat systems development from a high of approximately 75 in September 1985 to 58 in April 1986. This was caused by using some of the billets to build up the SSN-21 SHAPM and the loss of 7 billets to general cuts. During this entire period, the vacancy rate has been affected by the difficulty in hiring engineers into the government, inefficiency in the personnel system aggravated by the organizational changes in NAVSEA and the total hiring freeze.

NUSC's responsibilities have not changed with the change in organization. Their responsibilities are consistent with their TDA role and include:

1. Provide resolution of requirement definition issues and monitor development of CSDC, CAEP, SDD, Combat System Services software and overall software development. Identify potential and actual problems to PMS417 and propose work arounds, or other technical alternatives.
2. Provide the Program management and Combat Systems Engineering required to plan, direct, and coordinate the AN/BSY-1 tasks.
3. Provide RMA support for AN/BSY-1 Program.
4. Provide for TDA activities in the area of Combat Control including Systems Engineering, Platform Engineering, SIM/STIM, WLS, NS, and CC Software.
5. Provide technical direction and acoustic engineering support for technical design trade-offs, test criteria and systems performance.
6. Provide the planning/schedules requirements and coordination to support AN/BSY-1 test and evaluation.
7. Provide direct support for the ILS of Combat Control/Acoustic (CC/A) Set AN/BSY-1.
8. Provide support for the development of onboard, team and shore-based trainers with design review, GFI, models, data and system for onboard and shore-based training.
9. Develop and maintain effective operating guidelines for optimum employment of AN/BSY-1 Acoustic, Combat Control, FCS and OTH-T subsystems.

SUBMARINE COMBAT SYSTEMS

SEA 06V

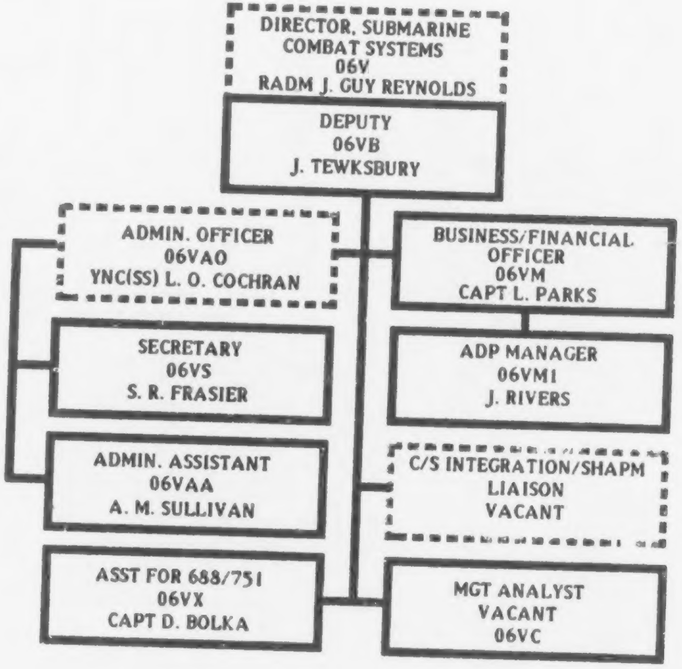
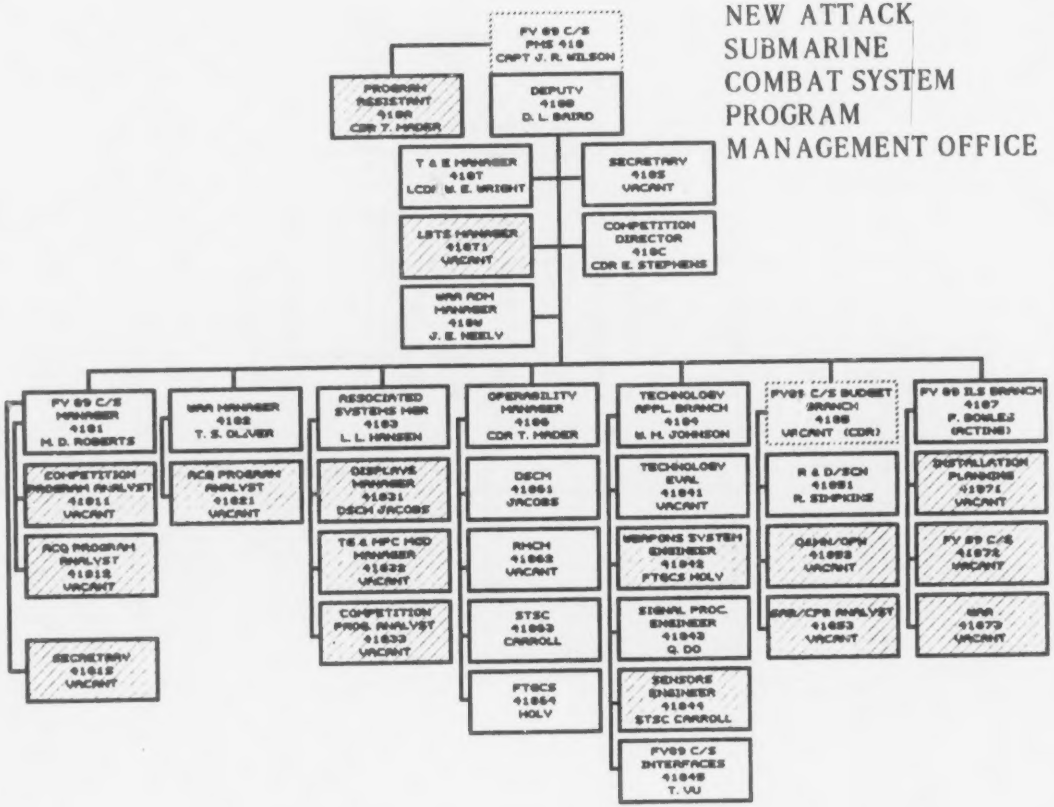

DIRECTOR, SUBMARINE
COMBAT SYSTEMS
06V
RADM J. GUY REYNOLDS
DEPUTY
06VB
J. TEWKSBURY
ADMIN. OFFICER
06VAO
YNC(SS) L. O. COCHRAN
BUSINESS/FINANCIAL
OFFICER
06VM
CAPT L. PARKS
SECRETARY
06VS
S. R. FRASIER
ADP MANAGER
06VM1
J. RIVERS
ADMIN. ASSISTANT
06VAA
A. M. SULLIVAN
C/S INTEGRATION/SHAPM
LIAISON
VACANT
ASST FOR 688/751
06VX
CAPT D. BOLKA
MGT ANALYST
VACANT
06VC

FIG (1)



NEW ATTACK
SUBMARINE
COMBAT SYSTEM
PROGRAM
MANAGEMENT OFFICE

FY 89 C/S
PMS 418
CAPT J. R. WILSON
PROGRAM ASSISTANT
418A
CDR T. MADER
DEPUTY
418D
D. L. BAIRD
T & E MANAGER
418T
LCDR W. E. WRIGHT
SECRETARY
418S
VACANT
LBTS MANAGER
418T1
VACANT
COMPETITION DIRECTOR
418C
CDR E. STEPHENS
WAA ADM MANAGER
418W
J. E. NEELY
FY 89 C/S MANAGER
4181
M. D. ROBERTS
COMPETITION PROGRAM ANALYST
41811
VACANT
ACQ PROGRAM ANALYST
41812
VACANT
SECRETARY
41813
VACANT
WAA MANAGER
4182
T. S. OLIVER
ACQ PROGRAM ANALYST
41821
VACANT
ASSOCIATED SYSTEMS MGR
4183
L. L. HANSEN
DISPLAYS MANAGER
41831
DSCH JACOBS
TB & MPC MOD MANAGER
41832
VACANT
COMPETITION PROG. ANALYST
41833
VACANT
OPERABILITY MANAGER
4186
CDR T. MADER
DSCH
41861
JACOBS
RHCH
41862
VACANT
STSC
41863
CARROLL
FTGCS
41864
HOLY
TECHNOLOGY APPL. BRANCH
4184
W. H. JOHNSON
TECHNOLOGY EVAL
41841
VACANT
WEAPONS SYSTEM ENGINEER
41842
FTGCS HOLY
SIGNAL PROC. ENGINEER
41843
Q. DO
SENSORS ENGINEER
41844
STSC CARROLL
FY89 C/S INTERFACES
41845
T. VU
FY89 C/S BUDGET BRANCH
4185
VACANT (CDR)
R & D/SCN
41851
R. SIMPKINS
QA/RM/OPN
41852
VACANT
SAR/CPR ANALYST
41853
VACANT
FY 89 ILS BRANCH
4187
F. BOWLES
(ACTING)
INSTALLATION PLANNING
41871
VACANT
FY 89 C/S
41872
VACANT
WAA
41873
VACANT

FIG (2)

AN/BSY-1 SUBMARINE COMBAT SYSTEM PROGRAM MANAGEMENT OFFICE

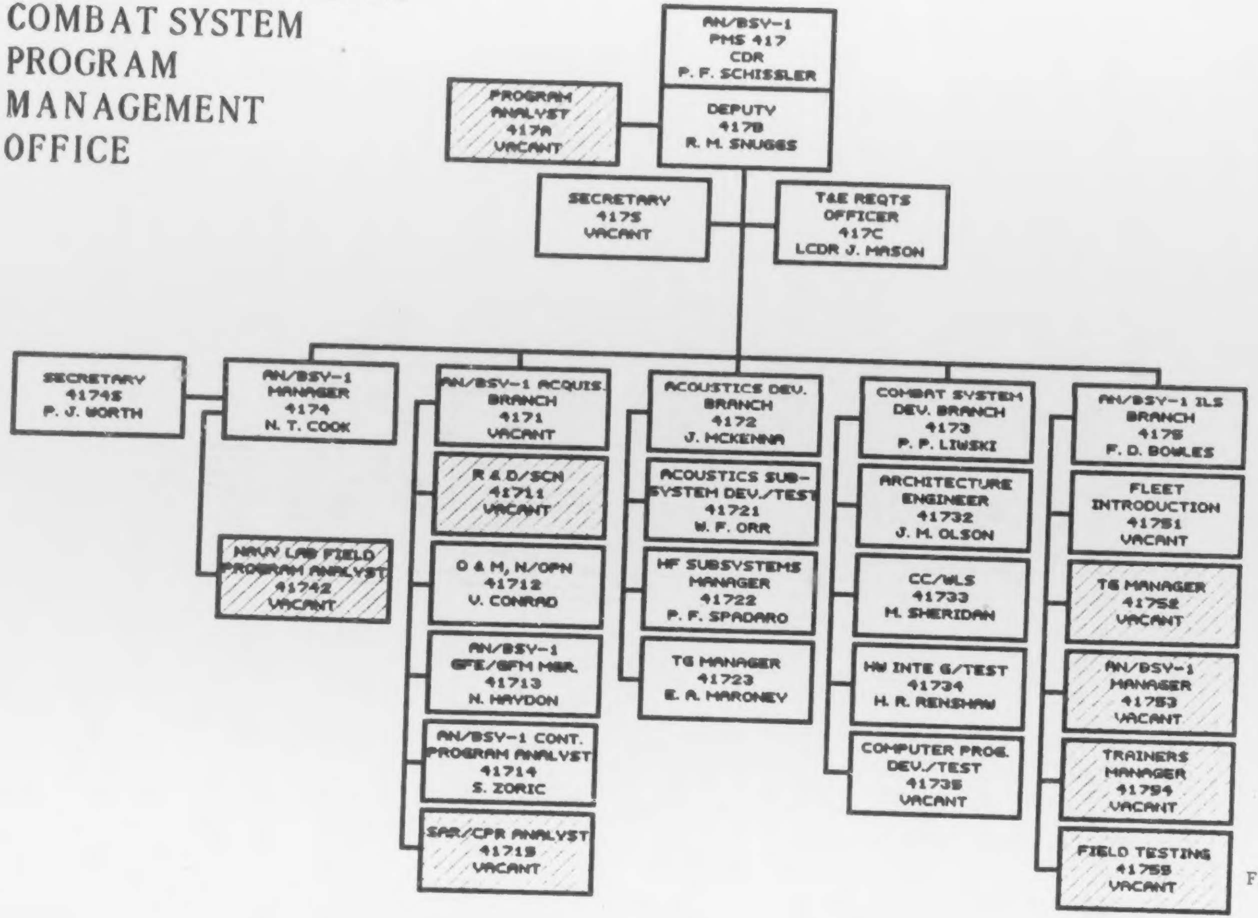

AN/BSY-1
PMS 417
CDR
P. F. SCHISSLER
DEPUTY
417B
R. M. SNUGGS
PROGRAM
ANALYST
417A
VACANT
SECRETARY
417S
VACANT
T&E REQTS
OFFICER
417C
LCDR J. MASON
SECRETARY
4174S
P. J. WORTH
AN/BSY-1
MANAGER
4174
N. T. COOK
NAVY LAB FIELD
PROGRAM ANALYST
41742
VACANT
AN/BSY-1 ACQUIS.
BRANCH
4171
VACANT
R & D/SCN
41711
VACANT
O & M, N/OPN
41712
V. CONRAD
AN/BSY-1
GFE/GFM MGR.
41713
N. HAYDON
AN/BSY-1 CONT.
PROGRAM ANALYST
41714
S. ZORIC
SAR/CPR ANALYST
41715
VACANT
ACOUSTICS DEV.
BRANCH
4172
J. MCKENNA
ACOUSTICS SUB-
SYSTEM DEV./TEST
41721
W. F. ORR
HF SUBSYSTEMS
MANAGER
41722
P. F. SPADARO
TG MANAGER
41723
E. A. MARONEY
COMBAT SYSTEM
DEV. BRANCH
4173
P. P. LIWSKI
ARCHITECTURE
ENGINEER
41732
J. M. OLSON
CC/WLS
41733
M. SHERIDAN
HW INTE G/TEST
41734
H. R. RENSHAW
COMPUTER PROG.
DEV./TEST
41735
VACANT
AN/BSY-1 ILS
BRANCH
4175
F. D. BOWLES
FLEET
INTRODUCTION
41751
VACANT
TG MANAGER
41752
VACANT
AN/BSY-1
MANAGER
41753
VACANT
TRAINERS
MANAGER
41754
VACANT
FIELD TESTING
41755
VACANT

FIG (3)

AN/BQQ-5/CCS Mk-1
SUBMARINE COMBAT
SYSTEM PROGRAM
MANAGEMENT
OFFICE

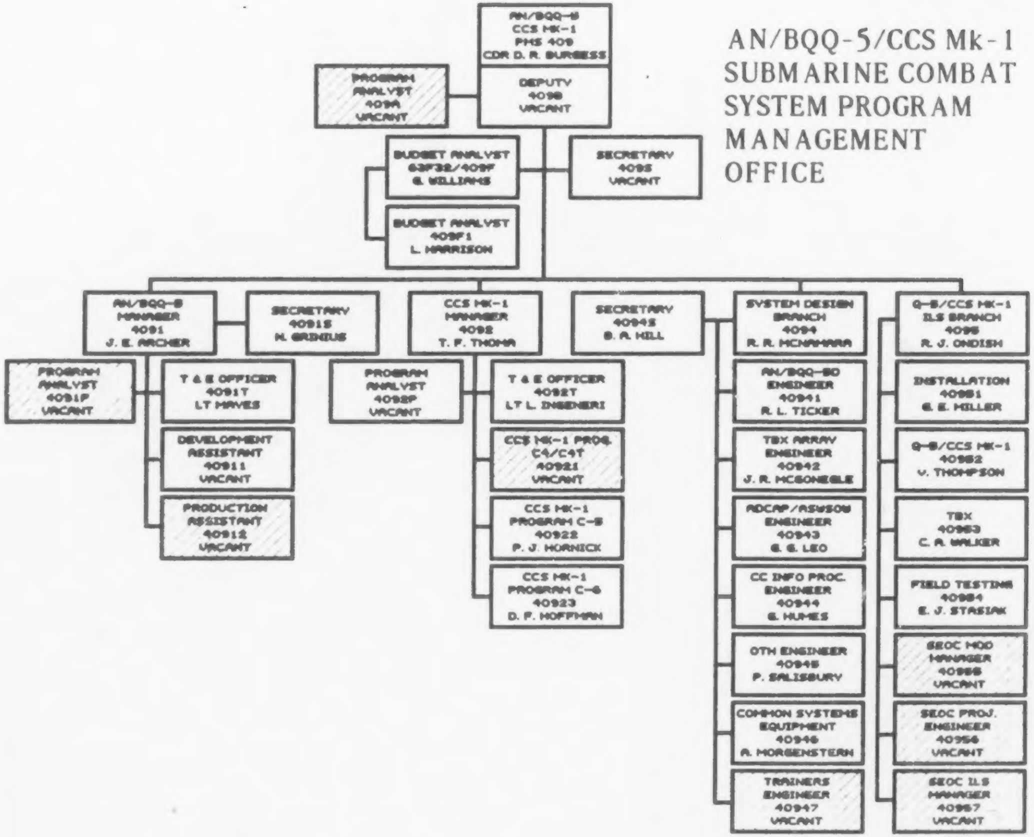

AN/BQQ-5
CCS MK-1
PMS 409
CDR D. R. BURGESS
DEPUTY
4090
VACANT
PROGRAM
ANALYST
409A
VACANT
BUDGET ANALYST
63F32/409F
G. WILLIAMS
BUDGET ANALYST
409F1
L. HARRISON
SECRETARY
4095
VACANT
AN/BQQ-5
MANAGER
4091
J. E. ARCHER
SECRETARY
4091S
N. GRINIUS
PROGRAM
ANALYST
4091P
VACANT
T & E OFFICER
4091T
LT HAYES
DEVELOPMENT
ASSISTANT
40911
VACANT
PRODUCTION
ASSISTANT
40912
VACANT
CCS MK-1
MANAGER
4092
T. F. THOMA
PROGRAM
ANALYST
4092P
VACANT
T & E OFFICER
4092T
LT L. INGENERI
CCS MK-1 PROG.
C4/C4T
40921
VACANT
CCS MK-1
PROGRAM C-5
40922
P. J. HORNICK
CCS MK-1
PROGRAM C-6
40923
D. F. HOFFMAN
SECRETARY
4094S
B. A. HILL
SYSTEM DESIGN
BRANCH
4094
R. R. MCNAMARA
AN/BQQ-5D
ENGINEER
40941
R. L. TICKER
TBX ARRAY
ENGINEER
40942
J. R. MCGONEGLE
ADCAP/ASWSOW
ENGINEER
40943
G. G. LEO
CC INFO PROC.
ENGINEER
40944
G. HUMES
OTH ENGINEER
40945
P. SALISBURY
COMMON SYSTEMS
EQUIPMENT
40946
A. MORGENSTERN
TRAINERS
ENGINEER
40947
VACANT
Q-5/CCS MK-1
ILS BRANCH
4095
R. J. ONDISH
INSTALLATION
40951
G. E. MILLER
Q-5/CCS MK-1
40952
V. THOMPSON
TBX
40953
C. A. WALKER
FIELD TESTING
40954
E. J. STASIAK
SEOC MOD
MANAGER
40955
VACANT
SEOC PROJ.
ENGINEER
40956
VACANT
SEOC ILS
MANAGER
40957
VACANT

FIG (4)

TECHNICAL RISK

Question. The Navy's SUBACS Alternatives Assessment Team led by the Director of Shipbuilding reported in July 1985 that "both alternatives (one of which is Navy's current plan) present a high risk for timely delivery of hardware or satisfactory software to SSN-751, the first ship." What is the Navy's current assessment of schedule risk to the SSN-751, for both ship delivery and the PSA upgrade?

Answer. The Navy's current assessment of the schedule risk to the SSN-751 is moderate based upon the following assessments:

Hardware Technical/Schedule Risk—Low.

Integration Schedule Risk—Moderate.

Software Development Risk—Moderate.

A phased delivery of capabilities plan has been developed for the FY83 and FY84 ships. The phased deliveries are planned so as not to impact ship deliveries.

Question. A December 1985 technical assessment of BSY-1 by DoD's Production Engineering Service Office (PESO) questioned whether the design maturity of the metal circuit cards and AFMX modules are mature enough to enter full production, and they consider the production line for the ceramic circuit cards to need further development. Delays in production of this hardware could lead to serious schedule delays.

Would you comment on the issues raised in the PESO report?

Answer. Only two hardware problems are worthy of note; the first, a card designated AFMX, which provides signal conditioning of the sphere hydrophones, showed inter-channel distortion. It affects active sonar and a design change has been identified and an alternative design built and tested. The second, is copper-invar-copper boards for the own ship data displays has shown slight delamination during thermal stress testing. The problem has been solved and qualification testing of several sources has begun.

Question. What is the schedule risk for the Copper-Invar-Copper circuit card and the AFMX modules at SSN-751 ship delivery, and what fallback options does the Navy have should these deliveries not occur in time?

Answer. Hardware risk has been reduced significantly by deleting most high risk technology and by resolution of ceramic module production problems. Unit testing is progressing well. The hardware technical and schedule risk is low.

Question. When will production of a reliable supply of these items begin and will it meet SSN-688 construction schedules?

Answer. These items are currently in production and SSN-688 construction schedules will be met.

BSY-1 CAPABILITIES

Question. In 1985, the Navy significantly restructured the BSY-1 program, resulting in a different system architecture and a series of phased deliveries. Will the BSY-1 system in the SSN-751 at ship delivery be as capable as the most advanced SSN-688 delivered to date?

Answer. The AN/BSY-1 system will be delivered in three phases to the SSN 751. The first delivery will include the majority of hardware and software and will provide basic combat system capability. The second delivery will provide ——— and will be available at ship delivery. The ship will then participate in shakedown operations which will provide the crew with familiarization and training. At the completion of shakedown a Post Shakedown Availability (PSA) will occur. During the PSA additional capabilities will be incorporated ———. This department configured SSN 751 will have significant combat capability improvement over the SSN 750. Additionally, the reduction ——— will allow the incorporation of ——— other improvements in SSN 751 tht were not possible due to space limitations in earlier SSN 688 class ships.

Question. OPNAV Instruction 4700.8 states that prior to ship acceptance trials, the following is required:

"All required . . . electronic equipment, armament, (and) missile and weapons handling gear . . . must have been installed, adjusted, aligned, tested, be operable . . . and capable of meeting performance specifications", and

"Certification of sonar, [and] other acoustic processors, . . . is required."

Will these requirements be met for the SSN-751?

Answer. Yes. All of the equipment required by OPNAV will be installed, adjusted, aligned, tested, be operable and capable of meeting the required performance specifications.

Question. At ship delivery, will the SSN-751 have the following capability: ———.

Answer. No.

Question. If not, when will these capabilities be added?

Answer. These capabilities will be added during Post Shakedown Availability.

Question. As part of the SUBACS restructure, ——— functions were deleted from the program: ———.

What impact will deleting these functions have on performance and mission capability of SSN-688's equipped with the BSY-1 system?

Answer. These functions are enhancements to the SSN-688. Deleting these functions does not limit the BSY-1 equipped SSN-688's capability to perform their assigned mission. However, as the threat continues to be quieter, these enhancements will become more important to mission success. When future updates to BSY-1 are considered, serious consideration will be given to including their functions.

Question. What impact will loss of these functions, as well as deletion of the fiber optic data bus, have on the ability to use the BSY-1 as a baseline for the SSN-21 combat system?

Answer. The loss of these functions ——— will have no effect on the ability to use the AN/BSY-1 as a possible base line for the SSN-21 Combat System.

Question. Provide a complete list of upgrades planned for the BSY-1 system, their schedule and associated costs, and explain how each upgrade will enhance or improve the system's capabilities. For software upgrades, provide the number of source lines of code involved.

Answer. The Wide Aperture Array is planned to supplement the AN/BSY-1 system during the FY92 to FY97 timeframe. The schedule is: FY92, 3 ships; FY93, 1 ship; FY94, 3 ships; FY95; 4 ships; FY96, 5 ships and FY97, 4 ships. The cost of this upgrade is being budgeted. The upgrade will improve the systems ability to detect and localize targets———. Because the 688 Class Wide Aperture Array will be a stand alone system, it is not anticipated to require changes to the AN/BSY-1 software.

Question. Significant capabilities are planned to be added to the first five BSY-1 ships during a major upgrade at PSA.

What are the incremental costs associated with the BSY-1 upgrade during PSA for the SSN/751 through SSN-755? Are these funds budgeted? If so, provide the years and accounts of funding.

Answer. The costs associated with the BSY-1 upgrade during PSA are included in the IBM capped contract except for utilization of the ADCAP and TOMAHAWK capabilities. These capabilities are budgeted in PE 64562 S0236 with $13.0M in FY87 and $17.0M in FY88.

Question. Did this additional work increase the planned duration of the PSA?

Answer. No.

Question. The Navy is planning a Phase III update to find, fix, and retest software resulting from deficiencies noted after PSA. Who pays if problems are encountered during the Phase III software upgrade?

Answer. If the problems encountered are a violation of system specifications, the prime contractor pays the costs to correct.

Question. When will SSN-751 through SSN-755 be combat ready?

Answer. At ship delivery.

Question. When is full certification of the sonar suite and combat system anticipated for these first five ships?

Answer. Full certification of the sonar suite and combat system for the first five ships will be completed within 60 days after the completion of PSA.

SOFTWARE DEVELOPMENT ISSUES

Question. Has the Navy designated a software support activity for BSY-1 mission critical computer resources? If not, why not?

Answer. Yes, NUSC is the designated software support activity.

Question. Has the Navy begun development of a BSY-1 software maintenance facility? Provide a funding profile for this facility by year.

Answer. The software maintenance facility is scheduled to start development in FY89 and be operational in FY91. $102.7M is budgeted in FY89 for the software maintenance facility.

Question. Is the size of BSY-1 system software at deployment still estimated to be over 4 million lines of code?

Answer. Yes, the estimate is 4.3 million lines of code.

Question. Given the size and complexity of this system software, can the Navy offer assurances that the development of BSY-1 software support activity and maintenance facilities are being accorded adequate leadtime, with some schedule margin for unanticipated software delays and changes?

Answer. The phased delivery of software was structured to provide appropriate risk reduction with some schedule margin for resolution of software problems. The restructuring of the program and the imposition of a cost ceiling have reduced the probability for the need for future change and imposed strict disciplines for making system changes.

BSY-1 PROGRAM APPROVAL

Question. The SUBACS program was initially scheduled for a Defense System Acquisition Review Council (DSARC) program review in November 1985. This review, however, was postponed and has continued to be postponed several times. A DSARC program review was tentatively rescheduled for March 13, 1986.

Mr. Paisley, continued postponement of a DSARC program review precludes formal high level reviews of the program and is often a sign of potential problems. What caused these schedule slips?

Answer. The formal DSARC was delayed to 12 March 1986 by mutual agreement between OSD and SECNAV in order to complete the cost ceiling modification to the contract. DSARC principals and staff personnel were formally briefed and kept abreast of the program status from November 1985 until the DSARC brief.

Question. Was the program review held on March 13th?

If so, what were the results?

If not, when will it be held?

Answer. The DSARC Program Review was held on 12 March 1986. The Secretary of Defense Decision Memorandum (SDDM) was issued on 16 May 1986 and authorized continued full scale development.

[CLERK'S NOTE.—The Department was asked to provide a more responsive answer but has not done so in time to be printed in this hearing volume.]

Question. The first contracts to implement this major program restructure were signed in March 1985, and the Navy formally approved the new plan in August. Yet, OSD review of this decision at DSARC will not occur until at least one year after the first contracts were signed.

What are cost and schedule ramifications if the Secretary of Defense made significant changes in the direction of the program at this time?

Answer. OSD reviewed the restructure of the program as part of the SSN-21 DSARC held in June of 1985. If significant changes were to be made at this time, there would be significant cost and schedule impacts to both the AN/BSY-1 and SSN 688 construction programs. These impacts are essentially the same as when OSD reviewed the restructure in June 1985, but now are more severe because of the delivery of SSN 751 being closer at hand.

Question. Given the documented problems in management control over this program in the past, how does Navy justify the postponement of a DSARC review until after all contracts to implement the restructure have been signed?

Answer. The management control of the program was not compromised during the review process. DoD principals and their staffs were being briefed throughout the process.

Question. How could the Navy objectively evaluate the recommendation of their Blue Ribbon Panel to adopt a BQQ-5 "like" architecture after having made financial commitments toward Replan III?

Answer. The financial commitments to Replan III are a subset of the changes required to go to a BQQ-5 "like" architecture. Specifically, the deletion of the system bus in favor of the AN/UYK-7(43) is the first step toward a BQQ-5 architecture. Other changes such as the weapon launch console end the sonar transmit system would have required significant changes to the ship design. These changes were evaluated by the follow on review committee.

Question. The GAO recommended that a Secretary of Defense Decision Memorandum be issued following the DSARC review. Is this part of the current plan?

Answer. Yes, a SDDM is pending.

BSY-1 CONTRACTS

Question. The BSY-1 contract signed on February 2, 1986 provides for cost penalties for late delivery or inadequate performance. The Navy is depending heavily on these penalties to provide strong incentives for good performance under the contract. However, OSD has recently written that Federal Acquisition Regulation 12.202 may disallow enforcement of the contract's penalties.

Explain how FAR 12.202 could undercut the use of these penalties.

Answer. The Joint Conference Committee Report for FY 1986 Department of Defense Authorizations provided that the Navy sign a contract modification which would provide for penalties for late delivery of equipment and failure to meet performance criteria. To comply with this, the Navy included a special clause in the contract modification entitled "Liquidated Damages for Late Delivery and Failure to Meet Performance Criteria". It is the opinion of the Navy that the special provision that is included in the contract modification complies with the Authorization Act and FAR 12.202. We are unaware of any OSD position in this matter.

Question. Is Navy concerned about this issue? Has a legal interpretation been requested within the Naval Sea Systems Command?

Answer. The Navy complied with the Congressional direction. The Navy believes that the special clause in the contract is fully enforceable. The Office of Counsel at NAVSEA was actively involved in drafting the liquidated damages clause.

Question. Prior to capping the FSD contract, the Navy was to finalize BSY-1 specification and statement of work in order to provide a firm baseline upon which to base cost estimates.

Were these specifications and statement of work completely finalized and documented prior to issuance of the Navy RFP? Prior to signing the contract modification?

Answer. The specifications and statement of work were finalized prior to signing the contract modification.

Question. Is the contract modification based on any specs or statements of work which were conveyed verbally but not in writing? If so, explain the scope of these items, and when their documentation will be complete.

Answer. No.

Question. Describe applicable acquisition policy and FAR guidance concerning the use of verbal clarification of RFP items.

Answer. FAR 15.606 provides guidance on the use of oral notification of changes in Government requirements. Discussions on the specifications and statement of work were held between the Contractor and the Government on a continual basis from redefinition of the program through award of the contract modification to convert to a ceiling price contract. With formalization of the specifications and statement of work all prior discussions with the contractor were formally transmitted in writing for proposal preparation purpose.

Question. The February 1986 BSY-1 development contract does not provide for warranties. However, there is a "latent defects" clause covering only the hardware for a period of six months after delivery of the system to the shipyard.

Is the prime contractor legally obligated to pay any costs to correct hardware problems which occur after delivery to the Navy?

Answer. Yes. The contractor will bear all allowable costs thus sharing 50 percent of the costs under the cost incentive provisions of the contract. If all costs of performance exceed ceiling price, the contractor bears 100 percent of any excess cost. Furthermore, FAR 52.246-3 also states "the Government may at any time require the contractor to correct or replace, without cost to the government, nonconforming supplies, if the nonconformances are because of fraud, lack of good faith or willful misconduct on the part of the contractor's managerial personnel or the conduct of one or more of the contractor's employees selected or retained by the contractor after any of the contractor's managerial personnel has reasonable grounds to believe that the employee is habitually careless or unqualified."

Question. Is the prime contractor legally obligated to pay any costs to correct software problems occurring after delivery to the Navy?

Answer. Yes. The contractor will bear all allowable costs thus sharing 50 percent of the costs under the cost incentive provisions of the contract. If all costs of performance exceed ceiling price, the contractor bears 100 percent of any excess cost. Furthermore, FAR 52.246-3 also states "the Government may at any time require the contractor to correct or replace, without cost to the Government, nonconforming supplies, if the nonconformances are because of fraud, lack of good faith or willful misconduct on the part of the contractor's managerial personnel or the conduct on the part of the contractor's employees selected or retained by the contractor after any of the contractor's managerial personnel has reasonable grounds to believe that the employee is habitually careless or unqualified."

Question. Is the prime contractor legally obligated to pay any costs to correct software problems which occur during post-ship delivery software upgrades, including PSA upgrades?

Answer. Yes, the same ground rules as above apply for delivery of AN/BSY-1 hardware and software at September 1988 for PSA installation. If a defect is discovered prior to March 1989 the contractor will bear all excess costs in accordance with the cost incentive provisions of the contract.

TEST AND INTEGRATION

Question. What percentage of total software development time is being planned for software integration and test, for ship delivery as well as for the planned upgrades?

Answer. Software integration and test constitutes ½ to ⅔ of the total software development time scheduled for both ship delivery and planned upgrades. The time planned for integration varies between modules because of varying module complexity.

Question. NUSC has recently advised the Committee that test and integration for ship delivery is still considered to be a high risk. Is this work covered by the latent defects clause? If not, has the Navy budgeted an adequate "risk factor" for this work?

Answer. All costs associated with the contractor performance during the test and integration part of the contract are included within the ceiling price. The start of integration is progressing well. Two test bays are on-line as of January 1986 as planned. The success of this phase of the program is key to controlling schedule risk. Integration and test is assessed as moderate risk for the November 1987 delivery and moderate risk for PSA delivery. The AN/BSY-1 hardware and software delivered as a result of test and integration phase of the contract is subject to the inspection clause of the contract.

TAO REPORT

Question. The DOD Technology Analysis Office contended in an October 1985 report that BSY-1 system software performance deficiencies will be outside the scope of the development contract with IBM. They stated that as a result, correction of software problems will be borne by the Navy.

Will the costs to correct deficient BSY-1 software be assumed by the Navy?

Answer. No. If the software does not conform to system specifications, the prime contractor will bear the costs to correct software deficiencies in accordance with cost incentive provisions of the contract.

Question. Is software or hardware the major contributor to BSY-1 risk for the first five ships?

Answer. The software and hardware in themselves are not the major contributors to the risk. The integration of the software with the hardware is the significant risk.

Question. Since the TAO review was completed three months before the BSY-1 contract was signed, explain why the Navy did not include any warranties to protect itself from system software design deficiencies.

Answer. The AN/BSY-1 full scale development contract was awarded on 16 December 1983. The February 2, 1986 contract modification capped the Government liability of the contract per Congressional direction. At the time of the initial award, the statutory requirements for warranties were not applicable and DAR 1-324.3, specifically states "warranties other than as contained in the clauses entitles Inspection of Supplies and Correction of Defects and Inspection and Correction of Defects shall not be included in cost reimbursement type contracts." The contract includes an inspection and correction of defects clause.

DCAA/DCAS REPORTS

Question. The Defense Contract Audit Agency (DCAA) and the Defense Contract Administration Service (DCAS) are required to conduct a preaward survey and post audit, respectively, of the capped BSY-1 development contract. In addition, the Navy Independent Cost Analysis Division of the Office of the Comptroller recently completed a cost assessment of the BSY-1 system.

What are the results of DCAA's and DCAS's analysis of the modification to cap the IBM contract?

Answer. A preaward survey is normally required when the information on hand or readily available to the contracting officer is not sufficient to make a determination regarding responsibility and capability to perform a proposed contract. Since this contract has been in place from December, 1983 and a determination of responsibility was made at that time, a preaward survey was not required by the contracting officer to execute the contract modification. To date a post award audit has not been performed on this contract.

Question. Did DCAA or DCAS raise any concerns during either the preaward survey or the post audit? If so, what were they and have they been addressed?

Answer. See question above.

INDEPENDENT COST ANALYSIS

Question. What are the cost estimates stated in the Navy Independent Cost Analysis study? Have the results been released yet. If not, why not, and when will they be released?

Answer. The following results of the Navy's Independent Cost Analysis (ICA) study were submitted to the OSD Cost Analysis Improvement Group (CAIG):

SUBACS/SY-1 INDEPENDENT COST ESTIMATE

	Millions
RDT&E plus procurement[1]	$3,416

[1] Quantity—19 ship sets plus MT.[2]

[2] MT = maintenance trainer.

OSD policy establishes the Department of the Navy ICA as input to the OSD CAIG independent cost analysis. The Navy estimate was released to the CAIG on Jan. 30, 1986. Results were released to OSD as input to CAIG analysis. Results were released to the OSD CAIG on Jan. 30, 1986.

Question. Will the results of the study be presented at the Program Review currently scheduled for March 13, 1986? If not, why not?

Answer. No, because the results were not available.

Question. In 1985, two modifications to the full scale development contract added $94.8 million to partially fund the development cost overrun. These funds were transferred from SSN-688 submarine program funds appropriated in fiscal years 1983 and 1984. The money was transferred without the use of a reprogramming action or any other notification of the Congress.

How is the Navy ensuring that the $94.8 million in SCN funds transferred to the BSY-1 program are being expended only on shipset production, not other RDT&E aspects of the program?

Answer. The contract is structured in the line item definition and statement of work by kind of effort and type of funding. The contract contains a clause which restricts the usage of funds to only the line items the funds are identified for. The Contractor is required to invoice all costs by groups of line items and by kind of funds identified in the contract. The funding transferred was from funding within the SSN 668 program and did not require Congressional notification.

Question. How much additional funding (by appropriations account) has been transferred from procurement to RDT&E to complete the BSY-1 shipsets for the five submarines funded in fiscal years 1983 and 1984?

Answer. No procurement funding has been transferred to RDT&E for the completion of AN/BSY-1.

Question. In FY 1985, the SSN-688 program and the Navy's Ships Parts Control Center (SPCC) made available to IBM a total of $75 million to purchase spare parts for the SUBACS system. Subsequently, the program and system were redefined resulting in the BSY-1 system that is substantially different than the initially planned SUBACS system. According to Navy officials, as a result of the redefined BSY-1 system, the original spare parts list is no longer accurate.

Since the combat system was experiencing technical and financial difficulties, and it was apparent that a redefinition of the systems was imminent, explain why the Navy still made funds available to IBM to purchase spare parts without revalidating the spare parts list.

Answer. Based on a spares proposal received from the contractor and verified by the Navy as required spares to the AN/BSY-1 system, the Navy awarded a contract modification in December 1984 to procure fleet support spares and installation and checkout spares in support of the FY 1985 AN/BSY-1 shipsets. At the time of this award, the Navy was not aware that the known technical and financial difficulties of the program would evolve into the magnitude of redefinition of the AN/BSY-1 program. Now that the redefinition of the AN/BSY-1 program or "Replan III" is contractually in place, the Navy has revised the spares lists and has directed the contractor to repropose the spares requirements to the revised fleet support spares and installation and checkout spares lists.

Question. Has IBM purchased any spares that are no longer needed due to the redefinition of the SUBACS system to the BSY-1 system? If so, what is their value and how will the Navy use these spares?

Answer. IBM has not purchased any spares which are no longer needed for the AN/BSY-1 system.

Question. If IBM has not purchased any spares with the $75 million, where are these funds, and who has control of them? Were they put to any other use?

Answer. The $75 million in question is obligated to the contract. The contractor has submitted invoices totaling approximately $23 million and has been paid approximately $17 million from this $75 million. These funds are in the control of the applicable Navy Regional Finance Center who is in charge of paying DCAA approved invoices.

COMBAT CONTROL SYTSTEM MARK-1

Question. The Combat Control System Mark 1 (CCS MK 1) provides development effort necessary to integrate new weapons systems into existing submarine command systems. The FY 1987 request for this program has been reduced over 20 percent from last year's forecast because of technical problems. What are these technical problems and which computer programs do they involve?

Answer. The 20 percent reduction from last year's forecast was not caused by technical problems. The reductions were driven by fiscal constraints.

Question. How have these problems affected testing schedules for the MK 48 ADCAP torpedo and the SSN 688 Vertical Launch System?

Answer. As noted in question 12A, the reduced budget was not the result of technical problems. However, technical difficulties were experienced in the Program C4 series software programs for CCS MK 1. The "technical problems" were initiated by late delivery of the AN/UYK-44 computers to the Land Based Test Sites. The initial program replan underestimated the impact of the late computers. A series of workarounds was subsequently developed in an attempt to maintain both the ADCAP and VLS schedules. Software development resources were limited such that only the ADCAP schedule could be met and the program was again restructured. The MK-48 ADCAP Torpedo testing is progressing with Program C4T in lieu of Program C4.1. SSN 688 Class VLS testing with full CCS MK 1 has been delayed about two years.

Question. An October 1985 Technical Audit of the CCS MK 1 program conducted by the Naval Underwater Systems Center was reportedly very critical of the program's ability to meet planned schedules. Would you summarize the results of this audit?

Answer. The audit was made in conjunction with the program office with contractor representation on the audit team.

The report was distributed by COMNAVSEASYSCOM letter 8282 Ser 409A1/2359 of 3 October 1985.

The audit report recommended the following:

Improve program planning and progressing against plan (cost and schedule realism).

Improve project management.

Improve productivity and development process improvement.

Improve technical management.

Question. What has the Navy done to address the recommendations made in this report?

Answer. The Program C4.1 contract has been capped and penalties have been established for late delivery. An on-site Navy team has been placed at the Program C4.1 prime contractor's plant to monitor progress. A joint Navy/contractor tiger-team has been established to concentrate on testing and debugging SSN 688 Class VLS software modules. These modules need the most work and accordingly have been assigned a high priority. Better metrics for defining work packages and measuring progress have been instituted (e.g. numbers of problems—PTRs—per 1000 lines of code, work-off rates, test steps run per unit time, etc.). The management organization at the prime contractor has been restructured to provide more detailed visibility into the product development process and the Navy team has increased staffing to monitor the work.

Question. Please provide the following for the record: A breakdown of FY 1986–88 funding by computer program development (e.g. C4.0, C4T, C4.1, C5, C6) by year.

[In millions of dollars]

Program	Fiscal year—		
	1986	1987	1988
C4T			
C4.1	$5.0		
C5	11.2	$18.0	$2.4
C6	1.4	3.4	3.3
	1.0	1.0	5.1

Question. A breakdown of FY 1986–88 funding by supporting weapon system (e.g. ADCAP, VLS/Tomahawk, BSY–1) by year.

Answer.

[In millions of dollars]

Program	Fiscal year—		
	1986	1987	1988
ADCAP			
VLS/Tomahawk	$6.0		
Sea Lance	4.5		
CCSIP	1.4	$3.4	$3.3
	6.7	19.0	7.5

Question. Please provide the planned dates for C4 series testing as reflected in the FY 1986 and FY 1987 President's budgets, as well as current estimated dates, for each C4 series program.

Answer. C4 series planned and revised testing schedules are:

Program	Planned	Revised
C4T	Aug/Dec 85	Aug/Dec 85
C4.1	Feb/Aug 86	Sep/Jul 88

Program	Planned	Revised
C4.2	Apr/Jun 90	

Question. How much of the $37.8 million appropriated for this program in FY 1986 has been obligated to date? Please provide the current allocation schedule for these funds.

Answer. Gramm/Rudman/Hollings funding reductions ($2.0M), plus OPNAV and OSD deferrals ($1.4M) have reduced the obligation authority for CCS MK 1 to $34.4 million. $16.6 million has been obligated to date. The allocation schedule for the remainder of these funds is as follows:

[In millions of dollars]

Month	Obligated	
	Amount	Total
March		$16.6
April	$12.9	29.5
May	1.5	31.0
June	3.4	34.4

Question. Given these technical problems, does the Navy still estimate that $47.1 million will be required in FY 1987?

Answer. As stated previously, technical problems did not cause the reduction in funding. The Navy will require the full $47.1 million to execute the program for FY 1987.

SEAFIRE

Question. What was the original development cost for SEAFIRE, and how does that compare to the Navy's most recent estimate?

Answer. There have been two SEAFIRE programs since 1979. The President's Budget, submitted in January 1978, included a preliminary cost estimate of $34.9M for SEAFIRE. The contract for the first program was signed in July 1979—18 months after the FY79 budget submission. Subsequent cost estimate for the first program, based upon the negotiated contract, was $68M. Because of a large increase in the contractor's original cost estimate, the Navy terminated the program in 1982. The program was recompeted in 1983 and a contract was let to the lowest bidder in November 1983. Using the cost of the second contract as a base, the total program cost estimate in November 1983 was $115M. Since then, the total cost estimate has remained constant, however, the program scope proposed by the contractor was substantially reduced. Initially, the contractor was to provide three Engineering Development Models (EDM); their last proposal offered only one EDM with concomitant increases in program technical, schedule, and cost risks.

Question. What is the Navy's near-term plan for finding a replacement for SEAFIRE? For the record, please provide a detailed schedule and estimated funding profile for FY 1986 and out.

Answer. The Navy is investigating the possibility of using less expensive "off-the-shelf" electro-optic systems as practical and more affordable SEAFIRE alternatives. Until the investigation is complete and an appropriate course of action is selected, there is no schedule or funding profile available.

NUCLEAR STANDARD MISSILE

Question. In May 1984, the Navy terminated the nuclear standard missile program due to budget constraints. Four months later, the Navy changed its mind, requesting reinstatement of funding based on the assessment that SM-2(N) "is an essential part of the Navy's air defense capability for the 1990's." Now the Navy has changed its mind again, reducing FY 1987 budgeted funds from $24 million to $9 million due to "program restructuring".

Is this a high, medium, or low priority program?

Answer. We continue to consider the threat for which the SM-2(N) is designed as a very high priority to counter. Alternate new technology conventional means to countering the threat are currently being investigated. If this investigation concludes that countering the threat with conventional ordnance is not feasible, then the SM-2(N) program is the principal option remaining against this high priority threat.

Question. What restructuring has occurred in this program, and why was it necessary?

Answer. In FY 1986, we requested $9.2M for SM-2(N) development but Congress appropriated only $3.0M, less than one-third of what is required to achieve the planned ——— IOC. The FY 1986 Congressional reduction forced us to stretch the development process. Accordingly, we reduced our FY 1987 budget request for the previously planned amount ($23.9M) to a level that is executable ($9.2M) in light of the FY 1986 appropriation. The current FY 1987 request represents a funding increase of approximately three times that appropriated in FY 1986. This is in consonance with last year's budget which projected FY 1987 funding at a level approximately three times higher than that requested in FY 1986 ($23.9M vs $9.7M). At the time the FY 1987 budget was submitted, we projected that the delay in the development program would cause ——— delay in IOC, but, in fact, this restructuring has caused a delay in IOC ———.

Question. The estimated total RDT&E cost for this program four years ago was $121 million. What is the current estimate?

Answer. The current estimated total RDT&E cost for SM-2(N) is $257.8 million.

Question. The estimated IOC ———. What is the current estimate?

Answer. The IOC for SM-2(N) is currently projected ———.

Question. The Navy has stated that SM-2(N) would deter the Soviets from escalating to nuclear warfare at sea. ———?

Answer. Without SM-2(N), the Soviets chances of success are greatly enhanced ———.

A ——— nuclear AAW weapons loadout was selected as a generic load following numerous studies. This mix is sufficient to sustain combat against multiple raids in a conventional, nuclear, or combined conventional/nuclear environment. ———. This deployment policy provides us the flexibility to ensure that the fleet's loadout of surface-to-air missiles is adequate to sustain combat against the prevailing threat.

Question. Does our intelligence data indicate ———?

Answer. ———.

Question. In a recent report, the Navy stated that safety in subsystems would be incorporated in the SM-2(N) design ———?

Answer. ———.

Question. This report also stated ———.

How does the Navy expect to realistically train its personnel in this complex battle management scenario?

Answer. Our AAW training is based on fundamental warfighting principles that do not change. Avoidance of "blue-on-blue" engagements is the governing principle in this case ———. SM-2(N) introduction will not increase our training requirements.

Question. What is the coefficient of reliability for the computer simulations cited?

Answer. The computer simulations used ———.

Question. In May 1985, the DoD issued a detailed "Report of the Working Group on Maritime Anti-Air Warfare Investment Strategy." This group was chartered to "develop a comprehensive maritime AAW investment strategy for both sea-based and land-based forces." After two years of study, investment recommendations were made, and they did not include the SM-2(N). Given the very real budget constraints which face us, the rising costs of the SM-2(N) program, and the lack of recommendation for its funding by this high-level group, how does the Navy justify the program's affordability?

Answer. The Working Group on Maritime Anti-Air Warfare Investment Strategy was aware of the Navy's SM-2(N) program. The group had no direction to address this ongoing program in their report; however, that does not imply a lack of support for SM-2(N). Although the study recommended specific Naval surface-to-air missile improvements and the working group appreciated the need for a complementary conventional and nuclear SM capability, there was no need to address specific requirements, except in a generic sense. The group recognized that SM-2(N) is not a substitute for conventional surface-to-air-missiles (SAMs), but would be used only when conventional SAMs are not adequate to ensure the sure-kill of incoming nuclear cruise missiles. SM-2(N) is an affordable deterrent to Soviet nuclear escalation at sea.

TOMAHAWK THEATER MISSION PLANNING CENTER

Question. Mr. Secretary, as you know, this Committee has taken a strong interest over the years in the adequacy of funding for the Tomakawk Theater Mission Planning Center (TMPC). In the past two fiscal years, TMPC funding has been reduced by Congressional action only 15 percent, when authorized funding levels would have led to reductions at least twice that amount.

Do you agree that the Tomahawk Theater Mission Planning Center is a vital Navy program, with its importance increasing as more Tomahawks are delivered into our inventory?

Answer. The Theater Mission Planning Center (TMPC) is a vital Navy program. Without adequate funding support, we will not be able to continue the planned performance upgrade that will achieve the mission planning capacity and responsiveness necessary to meet unified commander's future targeting requirements. Thus, a failure to upgrade the TMPC would undermine support for the Tomahawk Weapons System at a time when we are increasing our inventory of this missile.

Question. A recent report from the Director of Operational Test and Evaluation included the following statement concerning operational tests of the conventional Tomahawk land attack missile: ———.

At the same time, we see that Navy has reduced its FY 1987 funding for TMPC from $19.5 million estimated last year to $17.7 million in the President's budget. Is this adequate funding, given past reductions and concerns expressed by the Director of Operational Test and Evaluation?

Answer. The $17.7 million in the President's budget is adequate funding for the FY87 RDT&E effort in this program. Last year's estimate was based upon the then planned incremental improvement of the existing TMPC architecture. Analysis showed that approach could not achieve the future mission planning capacity and responsiveness required. Since then, new technology has become available that will allow a single upgrade to TMPC and achieve the required mature system performance. The TMPC program has been restructured to accomplish this upgrade while realizing RDT&E cost savings. The current FY86 incremental improvement will reduce conventional land attack missile mission planning time ———. The restructured upgrade program will further reduce mission planning time ———.

MARK-50 ADVANCED LIGHTWEIGHT TORPEDO

FUNDING PROBLEMS

Question. A recent industry journal stated that the prime contractor for the Mark-50 Advanced Lightweight Torpedo (ALWT) had begun laying off personnel due to a funding shortfall. The Navy has recently stated that approximately $4.5 million has been programmed into the Mark-50 account to keep the program on schedule.

Would you explain the cause and exact amount of this funding shortfall, how much funding the Navy intends to reprogram, and whether Congressional approval or notification will be required?

Answer. Cause: Gramm-Rudman-Hollings reduction, various unallocated reductions for inflation, Naval Industrial fund, contractor support services, contracted advisory assistance services, small business innovative research, and small business independent research and development.

Exact Amount: A $17.5 million shortfall in FY 1986 below the original "should cost" estimate submitted to Congress in 1983.

Reprogramming Funds: $4.6 million will be reprogrammed in FY86.

Congressional approval/notification required: No. The $4.6 million consists of $3.9 million below threshold plus $700 thousand restoral of funding previously removed from the amount Congress appropriated.

Question. $4.5 million in additional funding would only cover about half of the $8.6 million Gramm-Rudman-Hollings reduction, and the Committee is advised that this program had some modest cost problems before Gramm-Rudman-Hollings. Will $4.5 million be adequate to meet FY 1986 and 1987 schedules?

Answer. $4.6 million will be reprogrammed to support FY 1986 requirements. A schedule revision will be necessary for the FSD phase. A new transition-to-production plan is being implemented that will allow the program to stay within the major milestone thresholds established at Milestone II. Additional R&D funding may be required in the FY88–89 timeframe.

The Navy plans to initiate product improvements to the ALWT warhead in FY 1987. ———.

Question. Please explain the need for this improved warhead.

Answer. The improved warhead program is needed as a technical base to counter threat submarine improvements ———.

The new start for FY 1987 is to initiate the system development of several candidate warhead technologies ———.

Question. ———?

Answer. In an ASW engagement, prosecution of the submarine would continue until surfacing-capture and/or sinking. ———.

Question. Would you provide specific data for the record?

Answer. ———.

Question. What is the total estimated cost for this development, and the most likely IOC date?

Answer. ———.

SEA LANCE

ACQUISITION STRATEGY

Question. The Secretary stated that his new acquisition policy should result in cost savings over the life of a program. Have any analyses been conducted which estimate the cost of conducting Sea Lance FSD under a fixed-price contract and the potential for contractor cost-sharing in tooling costs?

Answer. Yes.

Question. What specific cost estimates were made, and how do they compare to the estimates reflected in the President's budget? Wouldn't this provide a valid alternative which should be considered at Milestone II?

Answer. The program will enter Full Scale Development (FSD) 1 July 1986 with a cost plus contract. The program will shift to a fixed price incentive contract following the Nuclear Depth Bomb variant Critical Design Review (CDR) which occurs in June 1987. This is consistent with the Secretary's position on fixed price contracts being established no later than CDR. The Program Manager's cost estimates and the Navy's independent cost analysis both show that required system capabilities can be developed within available funding limitations. Tooling for Sea Lance production units will be amortized over the production of the system.

Question. What is the overall technical risk of the Sea Lance FSD effort?

Answer. Low.

PAYLOAD VARIANTS

Question. In January 1980, DOD approved the requirement for an ASW Standoff Weapons, recently named Sea Lance. As a justification for Sea Lance, this document stated that one deficiency of the current ASW standoff capability was that the existing system "uses only a nuclear warhead and its use may be constrained by political factors in wartime scenarios." The requirement indicated that the Sea Lance should emphasize a conventional warhead as the primary warhead. However, in 1982, the Navy decided to pursue a nuclear depth bomb as the primary warhead and consider the conventional warhead later as a product improvement.

Please provide the estimate development cost, schedule, and IOC for the conventional variant.

Answer. Estimated development cost for the MK50 variant is $109M (the year dollars). Major schedule events are: Critical Design Review, February 1990; Contractor Flights, April–August 1991; TECH/OPEVAL, September 1991–March 1992; Milestone III (Production Decision), July 1992; IOC, ———.

Question. Last year, the Navy was considering acceleration of the conventional payload. What were the results of those discussions?

Answer. The Navy has concluded that, due to funding limitations in FY 87 and FY 88, accelerating the MK50 is not feasible.

Question. In 1983, the Navy stated that the number and mix of Sea Lance payloads would not be estimated until preparation for Milestone II. This Milestone is now only two months away. Please provide these estimates, by year of planned procurement.

Answer. ———.

Question. Has advanced development proven that Sea Lance will have sufficient positional accuracy in flight to permit effective use of the ALWT as the conventional payload?

Answer. The Sea Lance inertial system provides sufficient accuracy to permit effective use of the conventional payload. Development tests and analyses have shown that the specification requirements ——— are well within the system capability.

SSN 688 VERTICAL LAUNCH SYSTEM

Question. The Navy is requesting $18.3 million in FY 1987 to continue development of a Vertical Launch System for SSN 688 Class submarines. Mr. Secretary, last year this Committee directed the Navy to cap total R&D costs for this program at $224.4 million, and to submit future budgets in line with the cap. Yet the FY 1987 budget states a total cost over $240 million.

Why has the Navy not complied with the Committee's direction?

Answer. The Navy is concerned about the continued cost growth; however with the stretch out of the program due to late delivery of fire control software, it is not possible to complete the program within the committee's directed cap.

Question. What was the original estimate of total R&D costs for this program?

Answer. $133.3M in 1982 dollars. Subsequent to program restructure revised estimate was $160.8M in 1982 dollars.

Question. TECHEVAL for this system was scheduled to begin several months ago. Did this occur as scheduled?

Answer. Yes.

Question. What are the results to date?

Answer. The first submerged submarine launch of an inerted test vehicle occurred on 28 February. This test proved that the Capsule Launching System; ——— and the supporting ship system operated as intended. Subsequent test launches are planned to validate remaining launch performance parameters.

Question. What is the current estimated IOC?

Answer. IOC is now scheduled to occur ———.

Question. Provide a spending plan which includes a breakdown of FY 1986 testing costs.

Answer. FY 86 funding after offsets is $17.3M. These funds will be used as follows: —$5.1M for CCS MK1 Mod 2 Computer Program C4.1 development; —$3.0M for VLS system engineering and test planning support; and Navy activities to support system validation and documentation development. —$9.2M for baseline Capsule Launcher System (CLS) efforts and conduct of two FY 86 test launches; Inert Test Vehicle (ITV) launched 02/28/86 and TASM test launch planned for 08/86. FY 87 funding of $18.3M: —$5.0M for CCS ML1 Mod 2 Computer Program C4.1 development; —$2.7M for system engineering efforts, program coordination; and Navy activity support. —$10.6M for Capsule Launcher System efforts as follows: $2.3M for baseline qualifications and $8.3M for Tech/Opeval preparations and program long lead efforts to support Tech/Opeval now scheduled for FY 88.

Question. Provide the current estimated dates for FY 1986 and FY 1987 TECHEVAL and OPEVAL launches.

Answer. An Inert Test Vehicle Launch was conducted in February 1986. A Tomahawk anti-ship missile will be launched in August 1986. Both TECHEVAL shots will test capsule and ship systems prior to availability of full tactical fire control program. Remaining TECHEVAL and OPEVAL is scheduled for FY 88.

AIRBORNE ASW NUCLEAR WEAPON

Question. The Navy is requesting $1,615 thousand in FY 1987 to begin development of an airborne ASW nuclear weapon. What mission role would this weapon fulfill?

Answer. The FY 1987 President's Budget requests $1,615 thousand for development of Airborne ASW Nuclear Weapon, now called Nuclear Depth/Strike Bomb (NDSB). The NDSB is a multipurpose weapon designed for tactical and anti-submarine warfare. Dropped from patrol or carrier-based aircraft the ———. Navy jet aircraft can deliver the NDSB as a tactical strike weapon against shore and naval surface targets.

Question. Why is the weapon not mentioned in the Navy's June 1985 Air ASW Master Plan?

Answer. The Long Range Master Plan for Naval Air ASW Forces which was sent to Congress in June 1985 considered only conventional, not nuclear, weapons.

Question. At what depth range would this weapon detonate?

Answer. The military characteristics are still being examined by the joint Navy-Department of Energy Phase 2A Design Definition and Cost Study Group. However, current plans are for the bomb to detonate ———.

Question. What advantages does a nuclear depth bomb offer compared to a conventional bomb?

Answer. The principal advantage provided by a nuclear depth bomb is a credible deterrence against escalation to nuclear warfare at sea. Should deterrence against escalation to nuclear warfare at sea fail, a nuclear depth bomb improves our warfighting capability since it is invulnerable to potential countermeasures or false targets. Also, a nuclear depth bomb provides increased lethality against the modern, high speed, deep diving, double-hulled Soviet submarines.

Question. Has the Operational Requirement document for this weapon been finalized?

Answer. The Operational Requirement document is in its final draft phase.

Question. Describe options considered in the development options document, and explain why they were believed to be insufficient.

Answer. Option 1a: Develop a new depth bomb based on a variant of B61 nuclear weapons. 1b: Reconfigure the SEALANCE (ASW SOW) Nuclear Depth Bomb (NDB) for air launched NDB/strike usage. 2: Begin conceptual development for a totally new NDB.

The options considered in the development options document are considered sufficient by the Navy. The joint Navy-Department of Energy Phase 2A Design Definition and Cost Study is currently evaluating options 1a and 1b preparatory to entering Phase 3 Engineering Development in FY 1987.

Question. Provide an inventory profile and phase-out schedule for the B57 NDB, by year, and compare this to inventory objective and phase-in schedule for the airborne ASW weapon.

Answer. The B57 NDB retirement and airborne ASW nuclear depth bomb production are currently planned as shown. The current total inventory objective for the depth bomb variant ———. Fiscal Year: ———. B57DB ———; ASW NDB ———.

TEST AND EVALUATION SUPPORT

FUNDING INCREASES

The Navy is requesting $330.2 million for Test and Evaluation

Question. The Navy is requesting $330.2 million for Test and Evaluation Support in FY 1987. This program provides institutional funding for the FY Navy's major ranges and test facilities. The FY 1987 request represents an increase of 20 percent over the Gramm-Rudman-Hollings adjusted FY 1986 level. Mr. Paisley, how does the Navy justify such a large increase in this activity?

Answer. We made two major changes to what is funded in the Test and Evaluation Support Program in FY 1987. First, we added the Atlantic Undersea Test and Evaluation Center (AUTEC). Second, we have shifted funding for base operating support to the O&M,N account. When the net effect of these two changes are considered, the increase over the Gramm-Rudman-Hollings adjusted FY 1986 level is 15% and the increase over what was authorized and appropriated for FY 1986 is 8.7%. The justification for this increase is the continuing trend of increasing workload for our test and evaluation ranges and facilities and the need to reduce the backlog of maintenance and repair at these ranges and facilities.

MRTFB UTILIZATION RATES

Question. The Committee is advised that the ranges do not routinely keep data on their utilization rates, since there is no requirement to do so.

A. Is this true?

B. If so, how does the Navy evaluate the efficiency of the program?

C. If the Navy does not compile and verify data on range utilization at existing funding levels, how does the Navy validate the ranges' requests for increased funding levels?

D. Would the Navy have to compile this data from reimbursement charges, manhour charges, and other records? If so, how long would it take to provide accurate utilization estimates?

Answer. The test and evaluation ranges and facilities do keep records of utilization. Information on utilization rates is provided to the Commander, Naval Air Systems Command, and this information is used in the resource requirements validation list.

MRTFB COST ACCOUNTING

Question. DoD Instruction 3200.11 provides general guidance for delineating indirect test costs (which are budgeted in this program) from direct test costs (which are budgeted in individual weapon system accounts).

A. Does the Navy have procedural guidance and specific documented guidelines to assist program managers in implementing this directive?

B. If not, how is the determination of direct versus indirect cost negotiated?

C. How does the Navy ensure that identical test elements are not budgeted both as a direct cost and as an indirect cost?

Answer. Each Navy range and facility that is a part of the Major Range and Test Facility Base, and therefore governed by DoD Instruction 3200.11, issues it own detailed guidelines to implement the general DoD guidelines. The comptroller at each activity is charged with responsibility for ensuring that costs are charged as direct or indirect but not both. Compliance is further monitored by semi-annual headquarters level budget reviews.

PERSONNEL MANAGEMENT REFORMS

Question. Personnel system changes at the Naval Weapons Center, China Lake, California have reportedly been successful in increasing productivity. Would you summarize the results of this experiment thus far, and explain when the Navy intends to expand this concept to other Navy labs.

Answer. *Background.*—A demonstration project under the Civil Service Reform Act of 1978 was approved in 1980 at NWC, China Lake and NOSC, San Diego. The principal elements of the demo project are:

(a) Simplified Classification—the use of broad pay bands versus the current fifteen grades.

(b) Performance Based Compensation resulting from employee appraisal.

(c) Performance Based Retention.

The key element for management in the Demo Project is the simplified classification system. It reduces time and the number of actions necessary to operate the personnel process. It provides the assignment and pay flexibility needed to help improve personnel productivity. The two laboratories have experienced significant reductions in the frequency and time requirements for classifying and internal staffing of positions. They have seen improvements in the ability to attract and retain high quality professionals and the ability to reward employees based upon performance.

Status.—The project has been operating successfully and OPM, acting as the evaluator, has supported legislation to extend it government wide. Federal agencies have sought this extension and OPM is strongly supporting the current draft legislation which is a joint OSD/OSTP (Office of Science and Technology Policy) proposal. The draft legislation is to be presented to the Domestic Policy Council on 2 April.

PROGRAM TERMINATIONS

Question. For the record, please provide a listing of all Navy R&D programs terminated since FY 1986, by program element and project number. Please exclude from this list programs which were merely assigned new P.E./project designations as part of the normal programming process.

Answer. The following is a listing of Navy R&D programs terminated since FY 1986 by program element and project number. This list excludes those programs assigned new program element or project designations:

PE	Project	Title
63308N	W0440	Air-to-Air Missile Technology
63315N	R1764	Retract Yellow
63508N	S1827	CONAG
63509N	S1858	Voice Multiplex System
63518N	S0254	CV Navigation System
63717N	X1744	Battle Force Warfare Commander/Coordinator Software Modules Development
63717N	X1881	Automated Tactical Information Display System
63732M	C0867	Marine Corps Training Resources Management and Analysis
63732M	C1867	Joint Operational Interface Simulation Training System
63739N	Z1756	Performance Management Techniques
63788N	W0955	Rapidly Deployable Surveillance System
64213N	W1726	AAH Procurement
64215N	W0601	Aircraft Handling and Servicing Equipment
64220N	W0632	Aircraft Infrared Signature Suppression
64221N	W1876	P-3H
64511N	W0540	Photo Surveillance
64514N	S0247	Electrically Suspended Gyro Navigator
64567N	S1803	Ship Contract Design (note: moved to SCN)

PE	Project	Title
64656M	C0020	Landing Vehicle Tracked (Experimental)
64715N	Z1274	Air Intercept/Anti-Submarine Air Controller Trainer/Air Tactical Control Operator Trainer
64715N	Z1429	An-SWS-53 ( ) Maintenance Trainer
64715N	Z1605	TERRIER New Threat Upgrade Team Trainer
64717M	C1642	Marine Corps Tactical MT Vehicle
64718M	C1698	Air Droppable Soil Penetrometer
24575N	X1742	EW Readiness Support
25645N	W1750	Low Level Laser Guided Bomb
26624M	C0084	Marine Corps Combat Clothing & Equipment
26624M	C0939	Marine Corps Container Systems

PROGRAM NEW STARTS

Question. For the record, please provide a listing of all new start Navy R&D programs or projects in the FY 1987 budget, by program element and project number. Please exclude from this list programs which were merely conducted under different P.E./projects in FY 1986 and prior years.

Answer. The following is a listing of all new project starts in the FY 1987 budget request by program element and project number. This list excludes projects which were conducted under different program elements/projects in FY 1986 and prior years.

There is one new major program start in FY 1987:

PE	Project	Title
63318N	X1913	Advanced AAW System

There are several new project starts which are less than major acquisition efforts:

PE	Project	Title
63217N	W1636	E/O Advanced IRST Sensors
63588N	S1871	SSBN Survivability
64603N	W1844	Airborne ASW Nuclear Weapon
64719M	C1929	Advanced Tactical Air Command/Control Central (ATACC)

In addition, there are new efforts proposed which will not lead to systems acquisition, but are necessary to facilitate the conduct of certain kinds of developmental activities:

PE	Project	Title
63268N	W1921	Naval Airship
63269N	W1956	National Aerospace Plane Technology Program
63747N	X1933	ASW Advanced Technology Demonstration
65862N	S1957	Large Cavitation Channel

The following are projects which provide improvements to existing systems:

PE	Project	Title
63601N	S1917	RECO
63712N	T1884	Rapid Acquisition of Manufactured Parts (RAMP)
64713N	S1916	Surface ASW System Improvement
64714N	W1878	ASW Table Top Trainer
64221N	W1926	P-3D
24161N	W1924	External Drop Tank
26313M	C1931	Communications Ancillary Equipment
26625M	C1928	Tactical Electronic Reconnaissance Processing and Evaluation System

MANPOWER PERSONNEL AND TRAINING R&D

Question. While the Army and Air Force plan to decrease FY 1987 funding for manpower, personnel, and training R&D by 7 percent, the Navy's FY 1987 budget includes an increase of 31 percent for these items.

How is this justified?

Answer. There are three major justifications: (1) The Navy has *deferred growth* in spending for MPT R&D since 1980 to concentrate on hardware procurements. (2) Funds spent in this area are highly *leveraged.* (3) This R&D *Increases combat effectiveness.*

Deferred Growth.—We must now increase attention to pressing problems in manpower, personnel, training, and human factors engineering. Innovative and cost effective approaches to manning and training the 600-ship Navy must be developed, tested, implemented and evaluated. The modest dollar increase addresses these needs. Even with the increase, MPT R&D for the Navy and Marine Corps will be less than one fourth of the DoD total.

Leveraging.—Rough calculations show cost savings/avoidance exceed the total MPT R&D dollars being spent many times over. Examples:

(a) Simulation and Training Device R&D realize over 100 million dollars per year through reducing the need to develop new stations for each training device, standardizing software, modularizing computer hardware and an eye-tracked visual system that reduces resolution requirements.

(b) Human factors R&D on tactical information systems in sonobuoy placement will save about 100 thousand dollars per mission in aircraft and store expenditures.

(c) Human engineering work on the Bases and Stations Information System will result in a personnel cost avoidance of over 6.25 million dollars per year.

(d) Personnel R&D to enhance skill-level utilization and reduce costs associated with geographic relocation will achieve cost avoidance of about 52 million dollars per year.

(e) Training R&D aimed at reducing our investment in shore-based training for first term enlistees and enabling subject matter experts to author instructional materials should produce up to a 25 percent reduction in curriculum development expenditures.

Increased Combat Effectiveness.—Improved tactical information systems being developed with MPT R&D funds will lead to quicker and hgher quality information for combat decision makers. Higher enemy kill rates should result. The development of technology to simulate advanced sensors and integrate their information will enhance target recognition, decision time, and likelihood of hitting targets. Computerized training, especially for reserves will allow greater realism and provide better skill acquisition. Congressionally supported efforts to link selection tests with job performance, the development of computer-adaptive selection tests, and R&D on the assignment system will improve the management of our personnel inventory.

Therefore, the modest increase will reverse a trend of deferred growth, increase cost savings and avoidance in this highly leveraged area, and contribute to combat effectiveness.

[CLERK'S NOTE.—End of questions submitted for the record.]

Mr. DICKS. Thank you very much.

The committee is adjourned.

THURSDAY, MAY 1, 1986.

STRATEGIC DEFENSE INITIATIVE (SDI)

WITNESS

LIEUTENANT GENERAL JAMES A. ABRAHAMSON, UNITED STATES AIR FORCE, DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

INTRODUCTORY REMARKS

Mr. CHAPPELL. The committee will please come to order.

Today the committee will conduct a full day of hearings on the Strategic Defense Initiative (SDI). The Department of Defense is requesting $4.8 billion for SDI in fiscal year 1987. This represents an increase of 74 percent over the fiscal year 1986 level, and does not include an additional $603 million which is budgeted for SDI by the Department of Energy.

The Strategic Defense Initiative is one of the most controversial programs currently in the defense budget due to its high priority within the Administration, the rapid increases in funding, and the linkages to arms control. SDI is DOD's single largest program and received a 100 percent increase in fiscal year 1986 funding when other defense programs received decreases in real growth. The committee will receive testimony on a wide range of SDI issues today.

The principal witness today is Lieutenant General James A. Abrahamson, Jr., Director of the Strategic Defense Initiative Organization. We welcome you to the committee and commend you on the fine work you are doing. Your prepared statement will be placed in the record at this point, and we will ask you to proceed.

[The statement of General Abrahamson follows:]

STATEMENT BY LT. GEN. JAMES A. ABRAHAMSON, DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

Mr. Chairman, it is a pleasure to appear before the Committee to discuss with you the Strategic Defense Initiative. Three years ago President Reagan expressed the conviction that free people should live secure in the knowledge that their security did not rest upon the threat of retaliation to deter a Soviet nuclear attack. At that time he described the threat posed by increasing Soviet nuclear arsenals, and he proposed bold steps, embodied in a new initiative, to address that threat. This initiative called for a comprehensive and intensive research program to pursue the advances in technology that have the potential for strengthening deterrence by introducing a defensive component to our deterrence posture.

I believe it is important to reiterate the program goals and objectives as we move into our third year. The goal of the Strategic Defense Initiative is to conduct a vigorous program of research on emerging technologies in search of a better basis for a credible deterrence and strengthen the stability of peace through strategic defense. We envision that such a pursuit will offer incentives to the Soviet Union to join with us to reduce significantly or even eliminate ballistic missile forces. With this goal as a guide for the program let me describe for you the progress and status of the SDI.

It is necessary to spend a short time discussing the Soviet efforts in offensive systems because certain points bear repeating. Since 1969, when the SALT I process was just starting, the Soviet Union has built five new classes of intercontinental ballistic missiles and upgraded these seven times. As a result, their missiles are much more powerful and accurate than they were several years ago. The Unites States, in contrast, introduced its last new intercontinental ballistic missile, the Minuteman III, in 1969, which has been upgraded once. In addition, we are now working toward completely dismantling obsolete Titan II missiles. The alarming growth, both in quantity and quality, of Soviet ballistic missiles over the last decade is yielding a hard target, first strike force capable of accurately reaching its targets in minutes. The resulting asymmetry between Soviet and U.S. force structures has led to a destabilizing situation, one that must be redressed.

At the same time that it has worked to improve its offenses, the Soviet Union has continued to develop and improve active defenses. These active defenses provide the Soviet Union a steadily increasing capability to counter the retaliatory forces of the U.S. and its allies, especially if those forces were degraded by a Soviet first strike as provided for in Soviet military doctrine. Even today, Soviet active defenses are extensive. For example, the Soviet Union possesses the world's only operational anti-ballistic missile (ABM) system, deployed around Moscow. The Soviet Union currently is improving all elements of this system.

The Soviets are also developing components of a new ABM system that apparently are designed to allow them to construct individual ABM sites in a matter of months rather than the years required for more traditional ABM systems. The Soviet Union also has the world's only operational anti-satellite (ASAT) capability. In addition, the Soviets have an extensive air defense network, which it is continuing to improve. The Soviets have been aggressively improving the quality of their radars, interceptor aircraft, and surface-to-air missiles. The latest Soviet SAM, the SA-X-12 is capable of countering tactical ballistic missiles, the SA-X-12 and the SA-10 also may even have some capability against strategic ballistic missiles. The Soviet Union also has a very extensive network of ballistic missile early warning radars. All of these elements provide the Soviet Union an area of relative advantage in strategic defense today and, with logical evolutionary improvement, could provide the foundation for a decisive advantage in the future.

Since the 1960s, the Soviets have been pursuing research into advanced technologies for strategic defense. These technologies include high energy lasers, particle beam weapons, radio frequency weapons, and kinetic energy weapons. Moreover, during this same period, the Soviets have had an active and expanding military space program.

This information reinforces our need to pursue SDI research as expeditiously as possible, otherwise we face the threat of lagging seriously behind the Soviet Union in ballistic missile defense and all the negative implications for deterrence which would entail. At SDIO we are driven to pursue our goal of providing the technical basis for an early-1990's decision knowing that the Soviet Union is equalling our efforts or is slightly leading in many research areas.

In the first two years of our research, we have made substantial progress in all programs areas. Although more attention has been focused on the major accomplishments there have been numerous incremental advances in other major areas of the program. This has provided us with solid confidence that the systems we seek are highly possible. Advances in gallium arsenide production, research on infrared sensors, and designs of survivability technologies, among others, have produced promising results. All of the SDI Program experiments are geared toward providing the basis to support a conclusion that the Strategic Defense Initiative is technically feasible.

It is essential that we pursue the program in a manner that will enable us to make an early 1990's decision on whether to proceed to development. In one important SDI research area, directed energy weapons, the Soviet Union is equal to the U.S. in aggregate research but is leading the United States in some critical subareas. Directed energy technologies have tremendous capabilities as either ballistic missile defense weapons or as active discriminators of missiles and decoys.

For the near term we feel there is justifiable concern on the part of our intelligence community that the Soviet Union may soon be in a position to exploit the results of their long standing research efforts in ballistic missiles defense technologies by breaking out of the 1972 ABM Treaty.

Some critics of the program have questioned our position that a development decision in the early 1990's is needed. Perhaps a better question to ask is—can we afford to wait? The Fletcher Commission recommended, and our research has indicated, a decision to proceed with the SDI can be arrived at in the early 1990's. As the de-bates on strategic modernization and the intermediate range nuclear forces indicated, it is not clear there will be enough political support to maintain deterrence based solely upon offense forces. If, in the face of the Soviet buildup of offensive and defensive forces, the U.S. does not at least develop effective defensive options, the U.S. and our allies will one day find ourselves in a very dangerous position. You, as decision makers, could be left with no option to address this situation. Simple mathematics are all that's needed to add the five years of the U.S. research program, plus the length of time required in the development phase to reach a deployment date several decades after the Soviets began their advanced ballistic missile defense research.

Members of Congress will be faced with the decision whether we should conduct the program in a manner that will permit us to make a decision on the development of an effective defense in the 1990's or whether we should delay the program. If it is decided to slow that program so that potential defense options cannot be exercised in the 1990's we must ask, "Can we take the risk that the Soviet Union won't exercise its options to deploy ballistic missiles defenses?" Unfortunately, as we examine the Soviet Union's record on such matters, the answers become apparent.

As we move along in our research program, one criterion has become indelibly clear: We must be prepared to have the technical confidence and the political strength to reach the appropriate decision when necessary.

One point I wish to make needs to be fully understood: We are conducting the SDI Program in full compliance with our treaty obligations and international agreements. The President has directed that the program be formulated in a fully compliant manner, and the Department of Defense has planned and review the program (and will continue to do so) to ensure that it remains within the provisions of U.S. treaty commitments.

Before I discuss the fiscal year 1987 program I would like to discuss the realities of our program executive date. Some have asserted that the amounts of money we have requested for research are unprecedented and cannot be spent. In my testimony last year I indicated that I felt we would compare very favorably with the other services' research and development obligations and expenditures. In fact our obligation rate at the end of fiscal year 1985 was 94 percent, higher than the services and DARPA. Our expenditure of 40 percent was between the levels of the services. As far as SDI being unprecedented in requesting such growth in research and development funding, this is simply not accurate. The Manhattan and Apollo Program both experienced funding growth in excess of requests submitted by SDI.

Unfortunately, our requests for funding in previous years have been reduced significantly, forcing us to redesign program execution and planning. In FY 1985 and FY 1986 Congress reduced budget requests approximately 25 percent. Billion-dollar reductions have caused us to accept higher program risks, prematurely down-select certain promising technologies and in general pursue a more austere research program. The reduction of the requested budget levels by Congress has not, as yet, had the effect of slowing project schedules for the present proof-of-feasibility experiments. It has had the effect, however, of not allowing the SDIO to fund the alternative or fall-back technologies at an adequate level to minimize program risk. Thus, congressional budget reductions have had a harmful impact on SDI research and forced major program changes. We have been forced to reduce the effort on certain major technologies such as space-based lasers prematurely. This will increase significantly program risk and could cause program slippage, thereby delaying completion and increasing total costs. This is but one example of the many reductions we have been forced to make.

In FY 1987 we are requesting $4.8 billion to support research for the Strategic Defense Initiative. This funding level only attempts to move closer to the levels recommended by the Fletcher Study in 1983. It is imperative that we adhere to the funding levels if we are to reach our goal of providing sufficient information to support strategic defense decisions in the early 1990's. The FY 1987 request supports the architecture development, major experiments, technology development, and innovative science and technology research to achieve that goal.

Our approach to achieving the goal of providing the defense options necessary for an informed decision in the early 1990's has not changed. Essentially an SDI system, in order to be effective, must be able to detect the attack, track, identify and discriminate the target, intercept and destroy the target as well as battle manage and coordinate all these activities.

In addition, any proposed SDI system must be survivable and affordable. Our whole program is based on our desire to provide answers to these key technology questions to the decision making authorities, i.e., the President and the Congress, as thoroughly, rapidly and as cost effectively as possible. Our previous years' efforts have begun this process and the FY 1987 request expands the information.

By late FY 1985, Phase I of the System Architecture and Tradeoff Study was completed by ten industrial contractor teams. Classes of architectures for ballistic missile defense were identified an key issues in achieving those architectures explored. Phase II, with the number of contractors reduced to five, is examining the classes of architectures and issues in greater detail. While we have found a healthy diversity of opinion on how to resolve key issues, we also expect agreement on the key features of ballistic missile defense architectures. Points of major importance that have emerged are:

The most robust architecture combines both space-and ground-based elements. The space-based assets are configured to provide effective defense during the boost, post-boost, and midcourse phases of the threat trajectory. They also provide self defense and protect against various defense suppression threats. The ground-based components are used to engage the threat during the late midcourse part of the threat trajectory and within the atmosphere at high altitudes. The large number of opportunities to engage the threat with this architecture leads to an expectation of achieving very low levels of defense leakage even if the enemy proliferates his offensive forces in response to our defense.

We must fully explore technologies that could provide systems to engage hostile ballistic missiles in the boost and post-boost phases. The leverage afforded by defensive action at these stages of a hostile ballistic missile's flight can be decisive. Conceivably, the highest payoff and the greatest return for the defensive dollar investment would occur in these phases, before deployment of a missile's warheads and associated penetration aids.

Data handling, along with command and control technologies, for layered defenses must maintain a high priority within the SDI Program. No matter what evolves from our research in other areas of the program, reliable, resilient and responsive data handling and command and control capabilities are requisite.

Beyond the boost and post-boost realm, a high priority is to conduct thorough examinations of potential capabilities in other layers. The capability to perform defensive engagements in the midcourse and terminal phases is critical to the full exploitation of the advantages of a layered defense.

Good exoatmospheric discrimination is essential to effective midcourse defense. In addition, midcourse defense with good discrimination capability can offset the impact of fast burn boosters on boost phase intercept.

It is hard to overestimate the importance of the generation of realistic threat models, the estimation of the vulnerability of targets to the numerous kill mechanism options being exploited, and the development of strategies, tactics and technology to ensure system survivability to mission completion. These analyses and estimates will provide the boundaries for measuring success.

Success in nearly every element of the program is dependent on major advances in supporting technologies for Space-Based Electric Power, Power Conditioning Low Cost Devices, and Space Transportation and Logistics.

We must accelerate examination of potential applications to the short-range threat. Our security is inextricably linked to that of our allies. We cannot confine ourselves solely to an exploration of technologies with promise against long range, land-and sea-launched ballistic missiles. Thus, the architecture studies reinforce our views on the role of boost phase intercept; Discrimination of Decoys from Warheads; Midcourse and Terminal Intercept; Basing of Defense Assets in Space; Command, Control, Communications and Battle Management; and Threat Modeling, Survivability, and Target Vulnerability. At the same time, our research has already yielded important results from efforts specifically addressing these issues.

In discrimination, we have seen outstanding progress in imaging, particularly through Phased-Array Radar Technology and Signal Processing improvements. Equally important, the directed energy efforts have given us an approach to "interactive" discrimination.

The surveillance and sensor program areas have witnessed impressive progress. Miniaturization and advances in optical sensors have provided rapid gains in surveillence technologies. Multi-spectral measurements of Booster, Post-Boost Vehicle, and Reentry Vehicle Signatures have been obtained by both optical and radar devices. These measurements allow us to understand Threat Signatures and will be used in the development of Sensor Technology. Additionally, we have achieved significant progress in technologies for hardening of High Density Microelectronic Processors and Infrared (IR) Focal Plane Arrays against the effect of nuclear radiation that would be experienced during a battle.

In the directed energy field, work with Atmospheric Compensation and Free Electron Laser Technologies has progressed to the point where it appears that the potential for large, effective Ground-Based Laser Systems is very real.

In Electromagnetic Accelerator or "Rail Gun" research we have shown the ability to input high levels of power to these devices far sooner than expected. This means that heavier projectiles could be used and/or higher speeds attained.

A significant recent accomplishment has been the Midcourse Intercept of an actual reentry vehicle by an autonomous Terminal Homing Interceptor. This experiment proved the capability of a Nonnuclear Interceptor Launcher from the ground to demolish an incoming ballistic missile payload outside the Earth's atmosphere at a closing speed of over 20,000 miles per hour.

In hardening electronic circuits and devices for computers against nuclear radiation, we have fabricated and tested radiation-hardened, large scale, integrated circuits that show the potential for incorporating significant onboard processing for spacecraft in high radiation environments.

A Distributed Computer that networks and several standard commercial computers into a virtual Memory System is now operational. It is providing test beds for battle management concepts.

In lethality and target hardening, we have conducted many tests to analyze and quantify damage effects and vulnerabilities to radiation and high speed projectiles. One of the more graphic tests involved destruction of a rocket body by a laser on ground range. Other tests have examined the effects of X-rays on Laser Mirrors. Other effects tests have shown that small plastic projectiles travelling at 7 km/sec and impacting aluminum can create large craters.

The FY 1987 program is designed to pursue the technology development and architectural definition previously established. It is well beyond the scope of this testimony to mention every program encompassed in the vast array of SDI-related activities being conducted. I would, however, like to highlight some of the areas where we intend to apply the major thrust of our research effort in FY 1987. This year our research is evolving more from the technology development into major experiments. These experiments are more costly, but beyond any doubt, are required in order to answer technology questions. The very complex details of technical content schedule, cost and deliverables in each of these experiments are included in our classified descriptive summaries and the report to Congress. I will give specific examples in my briefing but let me mention some examples of these experiments. Major efforts in FY 1987 include the national test bed, the terminal defense tier tests, the endoatmospheric interceptor, boost surveillance system, space base BM/C^3 and the free electron laser. Without the funding to progress to the integrated experiment stage that these examples represent we clearly will not be able to answer to the satisfaction of our decision makers that we have solved the technological questions we face. The integrated experiments are the logical next step, they were never portrayed as being inexpensive but without them the probability of determining if the SDI is feasible is very low.

As we move into FY 1987, I would like to close by highlighting an area of particular importance. This past year we have shown progress in our dealings with our allies. Several allies have indicated support for SDI research and in some cases interest in participating. On December 6, 1985, the Secretary of Defense and the British Defense Minister signed a government-to-government agreement concerning SDI research involvement. A similar agreement was signed by Secretary of Defense Weinberger and the Economic Minister of the Federal Republic of Germany on March 27, 1986. Other allied governments appear interested in similar accords. U.S. and allied security remains indivisible and we will continue to work closely with our allies to ensure that, as research progresses, allied views are carefully considered. In addition to direct participation in the program, contributions by our allies could include innovative university research, individual exchanges, or subcontracts to U.S. industry.

Mr. Chairman, I hope my testimony today can advance the dialogue and understanding of what we have accomplished in the SDI Program. I continue to be excited about the progress we are making and the challenges we face. I look forward to working with you, the Committee, and your staff in pursuing the Strategic Defense Initiative. Thank you for this opportunity to present our research program.

SUMMARY STATEMENT OF GENERAL ABRAHAMSON

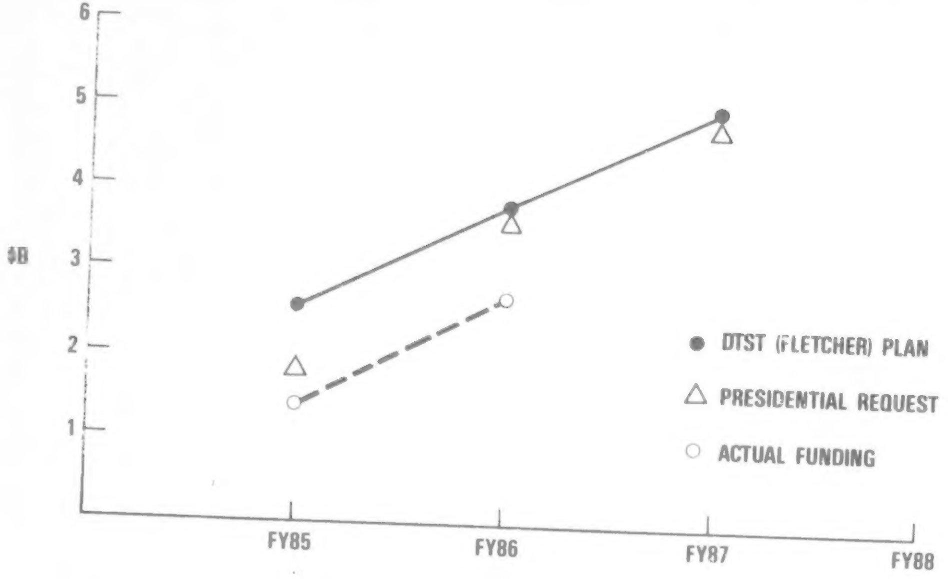
General ABRAHAMSON. This is an unclassified version for the record, and I won't comment further on that. In order to try to leave the maximum time possible for questions, I tried to put some of the overall highlights for the financial request together, as well as attempt to put some perspective on the question of our large experiments versus our technology experiments.

I will try to have the maximum amount of time for questions. However, I think a short introduction will be helpful. I would like to illustrate some of the things we are doing with some of the hardware I have. I think that will get it across just a little better.

[Slide follows:]

UNCLASSIFIED

SDI FUNDING SUMMARY



UNCLASSIFIED

SDI FUNDING

General **Abrahamson**. Again, at the time the program was initially laid out, at the end of the Fletcher Committee period there was a recommendation that a very aggressive technical program be pursued, and funded in the first three years at the high levels that you see on this chart. The initial request and what we have actually been funded has, of course, been substantially lower than what the Fletcher Commission recommended. Because of this, we have had to make choices. I will try to illustrate some of the major thrusts of those choices as we have been going through the program.

In 1986, our initial request was $3.7 billion, in red, you can see where we made most of the cuts in 1986.

Now, I would like to point out that this is a very dynamic process, and, in fact, right now I am going through the mid-year financial review. We are trying to institute a kind of cash flow management on this program to a much larger degree than other Defense programs. As a result of that, some of these are changing slightly as we see how implementation and contracting plans are developing over the rest of the year.

But this represented the initial cut of nearly $1 billion out of these areas. I will try to illustrate them as I just go through briefly what some of those have meant.

In our 1987 budget, and again unfortunately it is in red, you can see the ramp up where we had to cut down in order to recover some of the time and to readjust to some of the contracting plans. It didn't make sense to spend at a higher rate, but battle management and C3 truly are a critical part of the overall program.

We have to ramp up quite radically here in some directed energy projects because we are moving from what are component programs into large integrated programs. I will return to that later.

COMPONENT DEVELOPMENT VERSUS INTEGRATED EXPERIMENTS

The other judgments are similar increases but not quite the same percentage increase. One of the questions people continue to ask is, "How much money are you putting into what you call the integrated experiment versus some of the small component kind of work?" The assumptions usually behind that question are that the small component work is truly exciting, and it is. I will show you some examples of that and what it means to the overall program.

However, for something such as a free electron laser, you can't always continue to only put money into ion sources, electronic beams and mirrors separately. You must, in fact, assemble these things and see at some point if they will work as an integrated system. So it is still a technology experiment, but when you embark on one of those kinds of efforts, as we now have in the free electron laser, it becomes a very large effort.

Now, have we abandoned that? Have we abandoned the effort in basic technology when we do that? Actually not, but what we usually do is flood a great amount of technology work into a centralized integrated experiment, and you can see that those major experiments have a little over about half the budget. As we go further out in time, they will take even more of the budget. However, they do include much of the basic technology work. I will try to differentiate further as I go with some of these examples.

Remember that we are talking about a layered defense, we have all discussed that many times. So I won't go back to that. But I have tried to divide it into three fundamental categories.

The first one is the very critical, very expensive eyes of the system to do all those functions, in green. I have tried to show the next level of requirements associated with those. For example, in surveillance, it is not enough just to surveill the Soviet Union itself, because the threat may come from missile submarines, it may come from mobile missiles in other areas, such as in Eastern Europe; therefore, we must be able to have a global search volume that we can address consistently and reliably. There are those kinds of issues, all the way down through all of the areas of the eyes of the system.

The yellow part I consider to be the brains of the system and that is this function of battle management, command and control and the large amount of telemetry and information that must flow back and forth between components and finally achieve this proper balance between automatic features that are required but still have a means by which human beings can insure they can enter into the knowledge of the reliability of the systems operation and be able to stop things they consider to be anomalous.

In blue is what you hear about most of the time, the target bill, or the weapons, or in some cases antiweapons that we are talking about. Although you hear about that the most is not the majority of the funding of the program.

Now, I will try to illustrate again some of the component work but here are fairly large integrated experiments. These are all in the area of several hundred million dollars over a several-year period, some of them even more than that. To try and illustrate the thrust of what we are doing with these, I have selected two and only two. I selected one sensor system, the airborne optical adjunct, where I think we are making amazing progress. I will show you how and why I feel that way with the airborne optical adjunct.

But also I chose the space-based interceptors as a system that could provide early boost phase defense earlier than some of the directed energy systems, and I want to show you some of the areas of progress there. I will try to go vertically down through those two so that you can get a better understanding of research. I will not talk about the others, but obviously I will answer any questions about the other parts.

AIRBORNE OPTICAL ADJUNCT

Let's start with the airborne optical adjunct. Now, if it were to be deployed, we haven't yet decided whether it would be deployed in a drone or in a manned airplane or what kind of final deployment system you might have. However, we have tried to find a cost effective way to conduct the research program. The winning proposal, this was a competitive program, was to put it in the 767s, and to utilize the old original Boeing flight test airplane on the 767. We knew a lot about the aerodynamics of that bird. We also had essentially a free air frame to work in, so that is our test bed.

That doesn't mean we would automatically buy 767s in a deployed system, although clearly it could be an option. Most of the airplanes are filled in the back with computers, because this is a highly computer-intensive effort.

However, the key elements of it are two infrared telescopes sitting in that cupola on the top of that particular model. Now, the function of this is to augment an imaging radar on the ground so that you have two different ways in which you can look at incoming warheads, look at them from hundreds of kilometers out into space and make sure you can accurately characterize their trajectory on the way in.

The reason it is in an airplane is you would like to get up above all of the water vapor in the atmosphere so you want to get up above 45,000 feet, and the 767 is a fairly stable airplane up there.

Now a great amount of the work is going into the computers and the environs. I will show you some examples of that. Here is a mockup of the interior of the test airplane. The key element is this turret, which goes inside that cupola. Inside this turret are large mirrors, and finally a focal plane. That focal plane is made up of a high-powered infrared telescope and infrared sensors, heat-seeking sensors that allow you to look out at great distance and with very, very high levels of discrimination.

That is all part of the overall integrated program. As you can see, some of our component level technology work is absolutely critical in order to make it work. I really have only categorized three things as what I call breakthroughs, even though the press seems to keep overstating what I consider to be the way to describe our progress. One of them is right here, and it is in this component, in this infrared focal plane, the sensor. It is the little chip level of what we are talking about. It is a new technique for making these things called an impurity band deduction system and the key is, it is very highly radiation resistant. This is significant because even though this airplane is flying high, one of the countermeasures the Soviets would surely use is to set off high altitude nuclear blasts.

Those high altitude nuclear blasts would do two things against any kind of a system: One, you would have a very large infrared signature. You would have a huge flow in the upper atmosphere. We have computer programs based on some of the early atmospheric tests so we can measure and model what we think that would look like.

INFRARED COUNTERMEASURES

But the more difficult problem is there would be a burst of radiation which would come all the way down to that telescope and impact the telescope, and I will show you what that can do. Now the key is that a normal radiation sensor will do something, or an infrared sensor, when exposed to radiation, has a background level; that means it is giving off a general signal out here. Then when it sees a heat source, it gives a response and a signal.

However, if you put radiation on that and expose it, the first thing that happens is the normal background level moves, and, secondly, the signal moves, but they move a different amount. What that means is if it is exposed to radiation, your measurements are no longer reliable.

So we had to find a way to get around that, and we have. Here you can see a consistent level of background and signal even after radiation, and a key element of progress that will not only affect SDI, but can be used now in many of our military systems as we go ahead.

Mr. CHAPPELL. What is the difference in the background and signal?

General ABRAHAMSON. Background, if you just look out, not against a real warhead or against a heat source of some kind, but just look out against the night sky, is a base line.

This would be like against the night sky, and this would be if there were a real heat source out there. In this case, it is a measurable heat source in a laboratory.

Let me try to say what the implications of this are and, again, why I really feel we are making important progress. But it is not in this overall thing where you are just bashing down a missile somewhere. You see that every so often, but it is this kind of progress that gives me great optimism. Now this is a simulation, that means this is only being done inside a computer. This is not the real world. We are not setting off tests, nuclear tests, in the atmosphere. But one of the reasons that I believe SDI is now feasible, where ten years ago it wasn't, is because we can do these kinds of simulations now and do them so accurately with the computer programs we have.

[CLERK'S NOTE.—The slide provided by SDIO was not clear; therefore, it is not being printed.]

General ABRAHAMSON. This is a computer simulation of a threat. What this means is an SS–18 would have been fired out here, burnt out, separated a set of warheads, and also sent out a large number of decoys. Now, the decoys would be light balloon type decoys. That means that they have different heat characteristcs than a warhead, which is a heavy thing with a lot of mass and plutonium and uranium and things like that. You can see the temperature signature when you look out and see the temperature is different for the real warheads than it is for the decoys which are light weight and radiate their temperature at a different rate.

This is the ideal case we are testing against. Then we model what would happen if a bomb went off and the radiation would hit those sensors, and you can see what you do is create a mess. You just flat can't tell what has happened out there. If that were the final result, the Soviets would have an effective countermeasure. This would not be a realistic way to solve these problems.

On the other hand, with some of these radiation hardened detectors that I am talking about the situation is improved but not perfectly. Look down in here, and you can see that there is a little glob that you can begin to see, and some other little globs, but it is still not quite good enough to solve the real problem yet. We don't only work on radiation hardened detectors, we also look at electronic means of being able to solve this problem. That means just computer programs, software programs.

This is software, so many people say it is impossible.

Mr. AuCOIN. Why couldn't the Soviets heat the decoys?

General **Abrahamson**. They can. I can show you some things later on about those kinds of things. Remember, they not only have to heat the decoys, they have to be sure their dynamics are the same as these. They have to do it across either in space and perhaps the upper atmosphere, and when you begin to build such a complex decoy, the weight goes up and up. Finally as the weight goes up, you get to the point where it is not a decoy. If it is half the weight of a real warhead, you haven't gained much.

And I will show you some examples how we are working on it. We are not, contrary to what some of the Union of Concerned Scientists believe, ignoring these kinds of issues. We are spending a lot of time examining possible Soviet counter-measures. Let me come back, to that if I might.

Mr. **AuCoin**. If they can heat the decoys, that means heat sensors alone aren't——

General **Abrahamson**. That is right. That is one of my conclusions. We think interactive discrimination is a requirement.

Now, this goes back to that ideal simulator case, and we expose the system to radiation. It is an infrared sensor that doesn't have radiation hardening, but now we use some very special software techniques, just software, to be able to take that very difficult situation that I showed you and make it simple, and you can see just with software techniques alone, you begin to make the situation a lot better. It is still not perfect; it still doesn't match it, but you certainly have improved the situation dramatically.

When you combine the software solution and the radiation hard detectors, you are right back to what you really wanted to be able to do, discriminate effectively. That is a major achievement in both hardened components and also developing the software systems to be able to make these things work. That is the kind of solid work that is going on. It is not a breakthrough, but it begins to make these things possible.

SPACE-BASED KINETIC KILL VEHICLE

If I could just shift gears and try to give you another idea of why I think we are making progress and some of the promise of the system, and use an example of a potential weapon for BMD. This is what we call the space-based kinetic kill vehicle. This is just a rocket pod in the sky. Think of it like one of these rockets that you shoot off of a fighter plane, only it has a fairly cheap satellite kind of a garage up there that doesn't have to be pointed terribly accurately. These things have to be able to fire and fire quite fast, because if they fire slowly, one to two kilometers per second, you will need too many of these in space. In addition, at a lower speed you have to have so many that you can't get any effective firing radius. We think about the maximum practical speed is between five and eight kilometers per second, you can minimize the number of these you put out, because you can cover more range. That is the objective that you lay out.

By the way, this can't hit anything on the surface of the earth. It could be made to do so, but the reason we are not trying to make it do so is because you don't want to put any extra weight on it. The whole effort is to make it small and light because every pound you take off here means several pounds of rocket propellant that you take off. If it is light, as it gets down deep into the atmosphere, it heats up and burns. So it is a pure defensive weapon.

Mr. **Young.** Could I ask a question at this point? I understand you conducted some flexible light-weight experiments using a kinetic type weapon. Is that accurate?

General **Abrahamson.** Yes. Only, that one was aimed at a shorter range kind of missile. It is keeping that in mind, and it is in the atmosphere. If you would like, I will explain that to you.

Mr. **Young.** It had nothing to do with that particular kinetic system?

General **Abrahamson.** No.

Mr. **Young.** I will discuss it with you when we get to it.

General **Abrahamson.** Now here is an example of one of these rockets (indicating to model). As you see, it is just simple and fairly crude. We have some people working on today's version of this. The whole key is how big you make that front end, which has the hit-to-kill capability. It is just like the Army homing overlay intercept experiment, remember, we did back in June of 1984? The significance of that Army experiment was not that we shot a rocket from the ground and intercepted a missile. The significance of it was that we intercepted a missile in space, or a warhead in space, at very high speed. That meant that you had a maneuvering capability and a guidance system that could accurately just hit it square off, and that was the real importance of that experiment back in 1984.

It was not a terminal system. You shouldn't think of it that way. It had implications for this. What kind of implications? That experiment was nearly 2500 pounds big. It started a long time ago. There was no effort to make it low cost or to make it something you could put in space.

Today we think we can build a front end on these things weighing about 20 kilograms. That is around about 50 pounds, in that order of magnitude. If that were a 50-pound front end, and you had to have a maneuvering capability so that it can maneuver and get in the way of the warhead on the way in, and then it has to have an accelerating rocket, this whole thing would probably weigh between 700 and 800 pounds. Still too big. It would cost alot of money to get them all up in the air, get them in space, and get them ready. The basic cost would be too expensive.

We are now looking at the next generation of those kinds of systems. We are looking at them not only in the space-based kinetic kill vehicle program, but in another program, the railgun. We can design a front end that will even fire faster than this, but it will have the same kind of front end.

Here is a model of one of those front ends. There are four companies right now in a horse race procurement examining this potential.

Mr. **Chappell.** What is the scale of that?

General **Abrahamson.** This is real size. Here is one we think can be built 2.5 at kilograms. What does that mean for that kind of rocket? Instead of being a 700- to 800-pound rocket, it could be about 130 to 150 pounds. Now, it is beginning to be practical, and that is the key here. This is an infrared guidance system on the front end, so it can see the rockets on the way in. It has to have electronics to handle the guidance. It has to have a maneuvering capability, and here are gases and small maneuvering rockets on the back side so it can flip around, know where it is, move back and forth and intercept a warhead very accurately on the way in. This is the next generation of the system.

How and why could that be possible? Here you get a feel for some of our component research.

GYROSCOPE TECHNOLOGY

Perhaps the best way to show the progress we are making in many areas is to not use all SDI. In order for this to work, it has to have a guidance system that knows its altitude, knows whether it is pointed up or turned sideways and can maneuver very very accurately. That means it has to have an intertial gyro in it. Remember when you played with them as kids. You pulled the thing, and it had a rotating end, and you put it on an end of a glass, and all those sorts of things?

Most of our modern fliers have updated versions of those kinds of rotating mass systems. It is a fairly heavy black box, about 50 pounds with a lot of electronics. That is old technology, but that is what is in all of our fighters and all of the Russian fighters and in all of the fighters around the world.

However, this is the state of the art today. Honeywell is making these, and in future fighters and in some of the missiles and other kinds of systems, they will probably put in a ring laser gyro. It doesn't use a rotating mass. What it uses is small lasers that go back and forth across here, and as it moves, you can measure frequency differences. You can solve the problem of knowing what position this is in space. Now this is today's state of the art.

Here is a SDI ring laser gyro, which we have already developed, which, as you can see, is about a tenth of the size and weight of that system. This is an operable one, the lasers are operating. You can see that this is the next generation of ring laser gyros. However, we are not just working on ring laser gyros. That may not be the most cost effective kind of solution. So at the same time we are working on these inexpensive kinds of small technology items, but they have great significance, we have these developed already up at the Draper Laboratory.

You will notice it is bigger, but it is very much cheaper, and it is lighter. It is called a fiber optic gyro. Instead of a rather complex piece of plastic with lasers in it, it is just a coil of fiber optics, again a little laser goes around that coal of fiber optics, so it is a similar principle. It is a lot cheaper, and will be even less expensive when it is finally perfected. It is a little bigger, but one of the companies making these wants to wrap the gyro around the entire system. Light and cheap, but it is a different concept.

That is not enough. Another company has come to us, with something they developed on their own; they are investing in it. This is just a model of the size of it. It is a sonics kind of gyro system, just works on sound principles, really small, very expensive. So there are three generations of gyros that we are working on all at the same time, every one with the objective of moving forward and making one of the fundamental parts of this system smaller and cheaper so eventually it can be built at the very low size and weight and cost we are driving for.

I believe that can give you some idea of the relationships of the parts of the programs and the components. Let me give you just one other. This is a thruster, 50-pound valve that goes on. The tail becomes a thruster. I have another version which we can't find.

Mr. **Chappell**. So small you can't find it?

General **Abrahamson**. That is right. Which is about the size of the tip of my little finger. And that is, again, less than a tenth of the weight and again the same kind of an effort in technology. I guess the key really, so that everybody understands, is that the essence of this program's driving forward generations of technology and trying to apply them to systems like this so that they can all be cheaper.

That still doesn't solve the problem.

BOOSTER SIGNATURE RESOLUTION

Let me show you another area of progress that is pretty esoteric, but very important and that I am really gratified in. Just a year ago, we looked at what a booster looks like in space, the upper stage of a booster. Nobody really had looked at that very much. We just didn't know. So we got our theoreticians together and we made simulations. What happens is a booster in the upper stages, as it goes out in the vacuum of space, doesn't look like this big flame of fire that comes out the back as it fires. It is something that fires in the atmosphere because the atmosphere isn't there to push it and make a shape the way we all think it would normally.

[**Clerk's note**.—The slide provided by SDIO was not clear. Therefore, it is not being printed.]

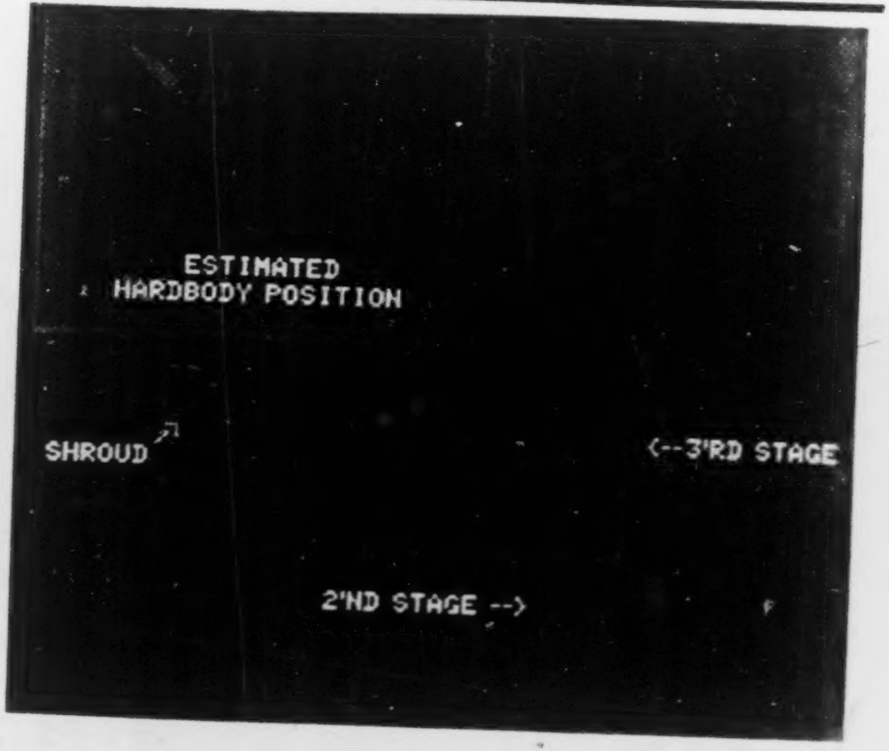
General **Abrahamson**. In fact, it is a huge thing many hundreds of miles across. Now, that is good for a satellite that is thousands of miles away that is trying to see it and get the initial targeting on it and get the initial trajectory. However, when one of those things comes in very close, you have to be able to insure that you are not going to miss the upper stage. This is a computer simulation, 25 kilometers on each of those squares. Here you can see some of the brighter areas and some of the dimmer areas, but this is hundreds of miles large. That little black dot is the upper stage. That is what we have to hit. We can't get confused by all of these reflections here.

So we embarked on a program to understand that. We have made a lot of progress in that program. There are infrared pictures taken from a telescope in a NASA plane, the Kyper Airplane. It flies out of Moffet Field in California. It is a NASA scientific airplane, and we have taken shots of liquid firings and also solid propellant firings, our own, not Soviet boosters.

Here we can see there is still some atmosphere, and this is the hottest part of the rocket. These are false color images, so you can see the differences in temperatures. That is not the real color you look at. You can see that is what you expect; that is what we are all conditioned to expect a rocket looks like. As it gets more out into space and the atmosphere gets less, it begins to get fuzzier and spreads out more.

[Slide follows:]

ESTIMATED HARDBODY POSITION


ESTIMATED
HARDBODY POSITION
SHROUD
<--3'RD STAGE
2'ND STAGE -->

General **Abrahamson**. Now we have computer programs. This is actual data, but we have digitized this data.

Down here, on the bottom, is the digitized data. We can now track and watch staging, that is when the big first stage falls away. The second stage falls away and you get the third stage. We can watch the shroud tumble off and see what that looks like, put that into our software equation, watch then the last rocket motor firing and put an estimated position in.

A good estimated position, a kind that will allow us to have one of those things be able to hit it, or from a much longer ways away be able to direct a laser against that booster, direct a laser that is looking out with different techniques.

This is the kind of work that is going on at many different levels in order to make this kind of thing practical, and also be workable against those kinds of measures and all other kinds of systems. When I say I think we are making great progress, it is because I am aware of these things. Unfortunately, it is not basing a missile, and that really is too bad because that is dramatic. That is the kind of thing people can see and understand simply and easily. But this is vital to our being able to go ahead at some point.

PROGRAM STATUS

You asked for our decisions and where we are. We have made such significant progress in certain parts of the systems. Because of where we have been cut back in our funds, I had to make some rather premature choices, and I felt since the whole nation is doing that, it was my responsibility to do it as well.

We selected one laser system as the primary system. We thought we had made such progress in the ground-based free electron laser and we had made such progress in related things like being able to get the energy up through the distortions of the atmosphere, that it made sense. I didn't turn off all the other laser programs, but I sure throttled them way back in order to be able to afford this one, because this is going to be an expensive integrated program, somewhere between $700 million and $1 billion.

Hopefully, we can have one of these lasers, a very large laser, operating at the ——— level in somewhere about 1990 to 1991. The biggest laser we have seen in this country is at ——— so you can see it is much much more, ——— larger. That is what we are aiming at.

Here is the point you made, Mr. AuCoin. At the time of the Fletcher Committee, people felt that passive discrimination, just looking with IR sensors, was going to be sufficient to deal with the problem. It is sufficient to deal with today's problem and perhaps the next generation, but we do know that they can do other things. ——— We are doing that, and we are studying them exactly. It is simpler than heating inside, wrapping resistant things on the outside.

We think we will not only need just simple techniques for weapons and decoys, but we will have to be able to go further, interact, do laser imaging, actively probe this or, in addition, use a neutral particle beam in addition. We are doing lots of these experiments, some of them you see the results, some of them you don't. This is very vital to our being able to put survivable systems in space.

I was really concerned about our probe in this whole area of command and control and communications. What I had was a lot of little technical programs going off in an uncoordinated way. So I needed a device to pull all this together, namely a National Test Bed (NTB). We now have selected four teams of contractors. NTB would facilitate the use of ground/based computer simulations, and eventually we will be able to reach out and go via satellite links to places where we have missiles, testing them in chambers and sensor systems, so we will be able to see that the simulation is valid.

SPACE TRANSPORTATION REQUIREMENTS

Mr. **HEFNER**. What will be the biggest piece of equipment that we will have to put in space, as you understand it, now? What is the size of it comparing it to a Greyhound bus, for example?

General **ABRAHAMSON**. It is hard to predict, but if we decide a neutral particle beam is a desirable and important element of the system in the future, we haven't really made that final decision——

Mr. **HEFNER**. Just assume you did.

General **ABRAHAMSON**. If we had, our current size projections for that are about two shuttle loads for putting one of those systems up, and that would be the biggest that I could imagine. The Neutral Particle Beam shoots out atoms of hydrogen at a very high speed. It is a very effective discriminator as well as potential weapon.

Mr. **CHAPPELL**. You are talking about a weapon now?

General **ABRAHAMSON**. It can be used either way, both as a weapon and as a discriminator.

Mr. **HEFNER**. Are you saying the weight of it would be equal to two shuttle loads?

General **ABRAHAMSON**. No, the weight is not the issue here, sir. It is big. It just has to have a certain amount of real estate up there, and we think we couldn't get that in less than about two shuttle loads.

Mr. **HEFNER**. That means you would have to assemble it in space.

General **ABRAHAMSON**. Probably. I personally don't think that is a major problem. There are other people who will disagree with me.

ERIS

Just to finish out then, we are continuing to make very important progress here for the other weapons in the kinetic energy areas, the space based kinetic kill vehicle. The ERIS is the follow-on to the Army's HOE experiment. We know we can do that. We have proved that is technically feasible.

Now our question is, can we make it affordable and inexpensive? So the contract that we have out, a major competitive contract, has to go through two different steps. The second step and most important part is to be able to produce one of these things, a full up round, for less than $1 million. Now, we won't prove that right away, you will prove that by seeing the kinds of technology that is in it, some of these kinds of things. We set that goal.

Mr. CHAPPELL. You say full-up around. What do you mean?

General ABRAHAMSON. That means the rocket that hits it in space, as well as the interceptor on the front end. Obviously there is a great deal of experimenting that still has to go on similar to what I have described. I took a little longer than I intended, but I hope that it gave a better understanding of at least a portion of the program.

Actually, we could tell a similar story in every portion of the program.

FIELD-HEADQUARTERS PROGRAM COORDINATION

Mr. CHAPPELL. Thank you very much. What is the coordination between your office and the people who run the experimental programs in the field? Do you feel you have close enough touch with them to get efficiency?

General ABRAHAMSON. We are trying to make that as efficient as possible. We direct from our central office the technical objectives of the program, since we have the money that makes it easier to make the decision, in terms of how effectively they are working that task. We lay out the schedule and the technical objectives.

When you get a cost reduction, my normal reaction is to say there is only one way to save money, and that is to do it faster. By the way, that doesn't always work, but so far people have tried to respond to that. We have thousands of people out there doing many small projects, and I have a small program office. But we use reviews, as I mentioned, I am going through my financial review biannually, and I think that we have effective control.

If there is a problem, it is in getting people to be aggressive enough and free of a lot of the other procedures that might apply to perhaps buying a B-1 or buying something like that and getting streamlined management, streamlined contracting that still meets the intent of the laws and our intent to have a highly competitive program. If there are problems, it is in that area, sir.

AVAILABILITY OF SCIENTIFIC MANPOWER

Mr. CHAPPELL. What about the scientific base? Do you have enough scientists to really do the job you are trying to do? I am talking about competent, talented scientists. We said ten years ago we didn't have them. We knew we didn't have them. Do you think we have enough now? Are we training them fast enough?

General ABRAHAMSON. Well, that is a tough problem that I am not sure I am really qualified to answer. I can say at this point we have not found that we can't attract really good people to each of the tasks. The tasks are so exciting and most of the people believe so strongly in what we are doing, they are anxious to come and work.

Now, whether or not that can apply to the future is a difficult problem, and our Scientific Advisory Board is at least looking at that question now, trying to predict and trying to see in some special areas. For example, optical engineers, there hasn't been a large requirement for optical physicists and optical engineers in this country in the past, and suddenly with all our emphasis on lasers, that is a new requirement. So we are trying to be quite specific and look and see, will we have enough not only to meet SDI needs but also to meet the needs of other programs? It is hard to estimate, sir.

SDI 1986 REPORT TO THE CONGRESS

Mr. **Chappell**. General, last year, the Congress directed DOD to submit a report on the progress of the SDI program. We still have not received the report, but we know one is out. Can you tell us why we haven't received one?

General **Abrahamson**. Yes, sir. It is a problem in final interagency coordination, and I believe that it is just imminent, so that we should have it over for you very soon.

Mr. **Chappell**. Is the problem with reference to the SALT parts of it?

General **Abrahamson**. The problems are to ensure that the administration as a whole is stating the policy aspects of the program effectively, in a way that will get across to all of the Members of Congress what we are trying to do.

Mr. **Chappell**. Is this the study we are taking about?

General **Abrahamson**. Yes.

Mr. **Chappell**. You expect to have it to us officially right away?

General **Abrahamson**. I think we are just imminent in having it here, sir. The other parts of it are not controversial on the technical program, the definition for that.

PROGRAM ELEMENT STRUCTURE

Mr. **Chappell**. SDI funding is consolidated into six program elements, which in fiscal year 1987 average over $800 million apiece. The size of the program elements is important in that DOD is allowed wide flexibility to shift funds among various projects within a program element without Congressional notification. The corresponding average size of program elements for the Army, Navy, and Air Force is $40 million.

Do you believe this budget structure lowers Congressional oversight and control of individual SDI projects?

General **Abrahamson**. I don't believe so, sir. Because it is such a complex program, and the requirements of the program are really quite dynamic, and we are trying to keep it as a dynamic program, meaning if there is an area of technology that is not going to pay off, I would like to be able to have the ability to say, "No, we won't proceed on that", and shift some of those funds in a year to another area, and if Congressional oversight went to the level of making judgments on the technical feasibility of where research was, I think that it would really not only hamper the program, it would probably go beyond what is really the intent of reasonable Congressional oversight.

There are many large programs that we won, and others that are single line items that are aimed at a particular objective. Congressional oversight doesn't go down into the level of saying that the engine should not exceed this and something else should not exceed that.

So, first of all, I would like to thank the Congress, because I think that you have been very generous in allowing us the flexibility to manage effectively within those five elements. I would like to go the other way, I would like to have a single element.

FY 1986 PROGRAM CHANGES

Mr. CHAPPELL. Thank you, General.

In fiscal year 1986, SDIO adjusted the funding profile significantly for many of its key programs. For example, laser research was reduced from $195 million to $113 million, whereas x-ray laser was increased from $10 million to $105 million.

Was Congress notified, or did we need to be notified of that restructure?

General ABRAHAMSON. In terms of the reduction, as I answered to the committee before, when people asked where would you cut, I laid out the general areas, and what you have cited is quite consistent with what I indicated would be reprioritized.

Mr. CHAPPELL. That is the reason we try not to be so specific and leave as much discretion with you as we did last year. Is that working all right?

General ABRAHAMSON. Yes, sir, it is. In terms of the x-ray laser and several of the others, there was a very specific problem there. Our lawyers looked at what we wanted DOE to do, and we discussed with several members and committee staffers and came to the conclusion that we could not transfer monies between the Department of Defense and the Department of Energy for work that legitimately fell under the Atomic Energy Act. The Atomic Energy Act requires we have a formalized transfer to DOE of $62 million of the total $100 million that we wanted to work with.

Therefore, we are in the process of having that transfer reviewed, but it has not yet been approved.

Mr. CHAPPELL. You are getting the flexibility you need? Do you have enough flexibility?

General ABRAHAMSON. So far, yes, sir. You know, program managers always want to have the maximum flexibility possible. The ideal case would be to have a single line item for the Department of Defense, and then obviously the research budget in the Department of Energy that is appropriate.

Mr. CHAPPELL. Mr. Young.

FLAG EXPERIMENT

Mr. YOUNG. Thank you, General. I had interrupted you during your presentation on the kinetic experiments, and I wanted to ask you about the so-called flag experiment. You did some tests?

General ABRAHAMSON. Yes, sir.

Mr. YOUNG. Were they successful?

General ABRAHAMSON. Yes, sir. It is a series of tests. Actually we have fired that particular vehicle. It is a program that started long ago that some people felt had no place in looking at a layered ballistic missile defense of the United States.

I felt that it needed to be supported in the context of our looking at the threat against short-range missiles, which is, of course, a theater threat not only to our allies, but to our U.S. forces and is within our overall directives to look at ballistic missiles of all ranges. So that is the context in which that series has gone ahead.

It has been a very orderly series where we have had first tests of the propulsion system, then the maneuvering guidance system, and the last one was a week ago Sunday. Secretary of Defense Weinberger announced Friday that we intercepted a target that was hung from a balloon. Well, that is just one in a series of tests.

The next one, if all goes well, will be fired in May against a target dropped from an airplane. The reason is because we want to fire that in the context of a well-instrumented range so we can understand the dynamics well. Eventually we will do more and more, probably about four more tests, in that series. I believe that has been a very successful series, yes, sir.

Mr. Young. Since you do plan to have more of these flag experiments and tests, do you have any plans to have a follow-on technology validation program?

I am asking you if there would be any follow-on program to determine whether or not this technology was a valid approach to the problem?

General Abrahamson. I believe the test program that we are working on is indeed doing that, validating whether or not this is a good technology for short-range ballistic missiles, and, in fact, I think we are already seeing the answer is yes. I would emphasize that this is not an operational missile development, this is an experimental vehicle, and if there were a decision that this would be the basis for a follow-on development of some kind, I think we would have the wherewithal to make that decision and make it confidently, but it is not an operational missile development.

SDI MINIMUM FY 1987 FUNDING LEVEL

Mr. Young. General, on the overall subject of funding this program, last year when this subcommittee took our bill to the full committee, there was an attempt to reduce the level of funding we were recommending. Fortunately you and I had a discussion that we presented to the full committee determining what the bottom line figure was for S.D.I. The committee was agreeable to that based on your testimony.

Do you think it would be a good idea to do the same thing now?

General Abrahamson. It is a good logical question, sir, and a proper one in the context of the very difficult choices that the Congress is facing this year, which perhaps are more difficult than any other year. Frankly, we always resist bottom lines because I am not sure that I always can state exactly where a final bottom line is. I can give you judgments about the impact of being able to cut, or cutting at certain levels and how we would implement those things, and if that is a request, we could do that.

Although I would like to think it through and present it for the record over a period of several months' evaluation.

Mr. Young. Why don't you do that. I am not sure how much time we are going to have before markup.

[The information follows:]

Our earliest estimates indicate that the minimum funding level required to sustain the current SDI Program is approximately $4.1 billion. This level of funding is required to merely continue contracts begun in FY85 and FY86. I would emphasize that this figure should not be substituted for our FY87 budget request of $4.8 billion which is necessary to institute new contracts, capitalize on emerging technologies and build on prior year efforts. In addition, $4.8 billion is necessary to continue a serious effort at researching the possibility of a defense against ballistic missile. Previous cuts have already forced downselection; added cuts of such magnitude simply will not allow the pursuit of key technology questions which must be answered by the SDIO.

SDI TECHNICAL PROGRESS

Mr. YOUNG. In a series of hearings we have had with you over the last several years, you have indicated a lot of optimism about how well the technology is falling into place. Has anything happened since our last hearings that would give you any reason to consider changing the philosophy or the concept of the SDI program?

General ABRAHAMSON. There have been changes, but I think they are second order changes within the program. Frankly, they are important. In terms of the overall philosophy of a layered defense and one that could eventually reach the objectives the President has laid out, no, I don't believe there is anything that has changed. In fact, I think we continue to be encouraged in that direction.

However, there are technical areas of emphasis that we are making, partially for budget reasons and partially for technical reasons.

Mr. YOUNG. Maybe you could expand on that for the record with some of the specifics.

[The information follows:]

Effects of last year's billion dollar cut to the program forced us to prematurely downselect some technology research. An example of this is the space-based chemical laser which underwent reprioritization following budget cuts. If the SDI program were to sustain a budget reduction of a similar mangitude in FY87 ($1-1.8 billion) our initial studies indicate it would force the curtailment of research in several research areas, notably in space-based sensors, kinetic energy weapons, and power options.

SDI FUNDING BY TYPE OF RESEARCH

Mr. YOUNG. Let me ask one more question before my time runs out. You had a chart during your presentation that had a list of categories.

General ABRAHAMSON. Yes.

Mr. YOUNG. You had some colored yellow, green and blue. Could you give us an indication of the percentage of funding you are considering for the three categories?

General ABRAHAMSON. Yes. We have a backup chart here on that, I believe. If you will dig around for that quickly. But it is a projection at this point with——

Mr. YOUNG. I was talking about the one that had a long list.

General ABRAHAMSON. If you recall, what it had was a green set that we consider the eyes of the system, the surveillance, and here you can see the basic projection. Now this will probably change as we go. The target kill and the weapon side of it in blue and the brain side of it in yellow. So this relates in that color code to that.

Now there will probably be a change here depending on some of the survey work that we are doing right now, and I personally believe that we need to reduce some of that effort and increase some of the work on battle management and C3. This is an older projection, but represents our best point now.

Mr. YOUNG. Is that chart provided to us for our record?

General ABRAHAMSON. If you would like it, we will give it to you.

Mr. YOUNG. I would like that, if you have no objection.

[The chart follows:]

[CLERK'S NOTE.—The chart provided by SDIO for the record was not the one requested. The correct one is printed as page 669.]

Mr. YOUNG. Please answer the following questions for the record.

[CLERK'S NOTE.—Questions submitted by Mr. Young and the answers thereto follow:]

GROUND BASED LASER MISSILE DEFENSE SYSTEM

Question. General, you have been quoted as saying that enough progress has been made on the Strategic Defense Initiative to ensure that a decision on whether to build it can be made by the early 1990s. Mr. Weinberger has said basically the same thing and he is quoted as saying that recent breakthroughs convince us that a ground-based laser missile defense system with space-based elements may be feasible by the mid-1990s.

1. Do you have any feel for a more definite time that a decision could be made and when a system could be deployed?

2. Mr. Weinberger has also said that the Soviet Union could have the ability to shoot down missiles with lasers by the end of this decade. He says that "They now possess ground-based lasers that could interfere with our satellites and by the late 1980s they could have prototypes of ground-based lasers able to hit ballistic missiles". Do we have that capability?

Answer. 1. The Fletcher Commission determined, and our subsequent research has also indicated, that the SDI research program could allow the President and the Congress to make an informed decision in the early 1990s on whether to develop and deploy defenses against ballistic missiles. Initial deployments would be feasible a few years thereafter, in the mid- to late-1990s. That timetable can be met, however, only if the SDI receives the requisite funding. Significant cuts to SDI budget requests, following on those registered in earlier years, would delay the time when an informed decision development and deployment could be made.

2. No.

Question. In November of last year, a Senior Soviet Official admitted for the first time that they are conducting experiments in space as we have alleged for some time. Three star General Nikolai Tchervov claims that these lasers are not space weapons but that they are used for "experiments and tests to locate and detect satellites orbiting in our direction." Do you believe these tests with lasers are important to their SDI effort?

Answer. Yes. These devices could be used for feasibility testing for ballistic missile defense applications, including active pointing and tracking development as well as for antisatellite-related work.

DIRECTED ENERGY TECHNOLOGY

Question. General Abrahamson, there are many people who are still skeptical when we tell them that the Soviets are indeed developing their own version of the SDI and that in some cases they are even ahead of us. Last year you testified that they were ahead in the ground based lasers and potentially ahead of us in the neutral particle beam technology. Where do we stand now? Are they significantly still ahead in these areas?

Answer. We believe that the Soviet Union has enjoyed a lead in the early development of some type of high power lasers and particle beam devices, and possibly still lead in work toward specific weapons applications. In some cases, they have progressed beyond research to actual weapons development. The U.S. SDI program would not have altered this situation. However, the U.S. is judged to be about equal to the Soviets in the overall level of directed energy technology.

Question. The Soviets continue to blame us for militarizing space, even though we know that they have the only operational ASAT and that they have the only ABM system. Last year, you told us that the neutral particle beam technology can only be used in space. That shoots a pretty big hole in their assessment that we are militarizing space and they aren't, wouldn't you say?

Answer. Yes; since the late 1960s the Soviets have been involved in research to explore the feasibility of space-based weapons that use particle beam technology.

CIVILIAN TECHNOLOGY SPINOFFS

Question. The civilian spinoffs of the SDI Program continue to pop up in trade journals but they are often overlooked by the public particularly those who do not favor the program. The medical potential of the free electron laser is certainly of interest as is the multiple uses of the gallium arsenide chip. Recently, I inquired about the civilian use of the work you are doing in the battlefield management area and was amazed that estimates of the potential civilian use in that program, even through it is specifically for battlefield management, run in the 75% range because of the computerization issues being discussed and the communication advances that are contemplated. Are there other facets of the work you envision that will be useful in the civilian sector?

Answer. Yes, some examples of SDI technological developments that have potential for technology transfer and civil applications are:

Computer data processing speed and efficiency enhancements through improved components, circuitry and software.

Electronic components which are lighter, smaller, more capable and energy efficient.

Software with artificial intelligence that would allow computer systems to learn from experience and be able to make realistic deductions.

Optical computing using laser light instead of electrical circuits for data transmission and other optical applications.

Electrical power systems which are more efficient and less expensive.

Sensors which are lighter, smaller, more sensitive, and less expensive for medical, manufacturing, research, control systems, and a host of other applications.

Cryogenic cooling systems which are lighter, smaller, more efficient.

Light weight mirrors with computer-controlled adaptive alignment for laser applications to manufacturing processes.

Electrical systems hardening techniques applicable to reduction or elimination of noise and other interference in communications systems.

Tracking and pointing technology developed for surveillance may be valuable in applications to commercial aircraft guidance and control and ground traffic monitoring.

Tomography associated technology which may enhance medical techniques for location and discrimination of soft tissue abnormalities.

Integration of laser technology, robotics and computerized precision control techniques into applications associated with a host of manufacturing processes, and bio-medical applications.

The broader utilization of these and other SDI technologies promises to be of significant economic benefit to the nation.

SOVIET RESPONSE TO SDI

Question. General, if we had not stopped the ABM work that the Army was deeply involved in back in the '60s and '70s—where would we be today with an ABM system? Would the Soviet system be the same or would it be better because we continued to evolve a system of our own?

Answer. Given a vigorous U.S. R&D effort on BMD, the Soviets could possibly have benefitted from technology transfer. However, it is important to note that the Soviets have continued to improve and upgrade their system in spite of the U.S. decision not to deploy.

Question. If we stop or slow down on our development of SDI, is there any reason to believe that they will do likewise?

Answer. The Soviet Union's commitment to strategic defenses and advanced strategic defense research has been long-term, extensive, and well supported. There is evidence of Soviet research programs existing since 1960, in some cases in every major area of U.S. SDI research. There is no evidence that they have changed their program plan as a result of SDI.

SOVIET ACTIVE MEASURES CAMPAIGN

Question. General, we have seen the Soviets conduct an extensive "Active Measures" campaign including false information, overt propaganda and covert manipulation of Western democratic groups and news media through a network of Soviet front organizations. These front organizations include the World Peace Council, World Federation of Trade Unions and the Christian Peace Conference. I am personally aware of some of these activities from my work on the House Permanent Select Committee on Intelligence and in particular from my friendship with Stanislav Levchenko who knows a great deal about the Soviet Campaign because he is a former Major in the KGB whose job it was to run an active measures campaign. Stan says that the S.D.I. is the number 1 point of Soviet propaganda and that the Soviets are using "Active Measures" to defeat our S.D.I. plans. Does his prediction agree with any analysis that you have done on the media treatment of S.D.I.? Do you think that any of the opposition that has developed in this country and in Europe is the result of the Soviet's Active measures campaign?

Answer. It is clear that the Soviet Union is very interested in stopping the SDI. I believe that it will use any and all propaganda means at its disposal. In an open and free society criticism in a program of the magnitude of the SDI is to be expected. We recognize that a healthy debate on the issues is a viable component of our democratic process. However, it does disturb me when arguments used by opponents envelope the same fallacious assertions used by the Soviet Union.

Question. A senior editor at the Reader's Digest magazine is quoted as saying that the Soviet efforts will be aided in their disinformation campaign because of the relative scientific and strategic ignorance of the U.S. news media. He says "in great segments of the American media there is a general ignorance of strategic and technological matters." Do you agree with his statement?

Answer. I believe we have seen a great increase in technical sophistication of U.S. news media on SDI issues. The quality of technical reporting on the SDI, in specialized publications such as trade journals has become quite good. At the same time, there is definitely still room for improvement in the general media's presentation of complex, but vital, strategic and technological issues.

[Clerk's note.—End of questions submitted by Mr. Young.]

Mr. **Young**. Thank you very much. Thank you, Mr. Chairman.

Mr. **Chappell**. Mr. Murtha.

IMPACT OF CONGRESSIONAL REDUCTIONS

Mr. **Murtha**. General, would you go through the funding profile, starting back in 1985, as far as what we missed out on by the reduction in funding and what we will miss out on next year? I figure the rate is going to be around $3.5 billion rather than the rate you are projecting. I am just guessing.

But knowing the problem we have, and listening to Congressman Gray with his problem, defense is going to be squeezed down, and we are going to have a lot less money available than we hope.

General **Abrahamson**. Here is an example, sir, of some of the specifics. It shows you in ground-based laser work. In spite of the funding cutback, I felt that we did need to increase that effort, so we did that.

Mr. **Murtha**. No, what I am talking about is, I remember when you first made your presentation a couple years ago, you said the funding in the initial stage is so important because we have to decide which direction we are going. Now, obviously you didn't get as much money as you wanted, so what was under-funded, and what decisions couldn't be made, and how much have we been delayed because of this reduced funding?

General **Abrahamson**. If I might give you one example of the way I have tried to deal with this, and you can perhaps get a feel for what this means, the original Fletcher report laid out parallel lines of directed energy research and indicated that they could be very highly productive and very effective. They had about five different parallel lines, meaning you would look at free election lasers, chemical lasers and put some of them in space and some of them on the ground.

I was forced to make a premature decision on a particular version of the free electron laser, the induction version, this is the one being developed out at Livermore primarily, although there are contractors contibuting to the work. But I selected them and put the others——

Mr. **Murtha**. You say premature. If you had had more money, what would you have been able to do?

General **Abrahamson**. I would have carried through some of the other systems. What that means is we are all operating at a much higher risk level because I don't have some of the backup laser technologies that were originally planned for in the program.

Mr. **Murtha**. How many decisions did you have to make in the first year prematurely?

General **Abrahamson**. The first year not a great deal, because what I made some very important adjustments to the technical goals and tried to align the technical program.

Mr. **Murtha**. How much were you delayed by reduced funding the first year?

General **Abrahamson**. The first year, in certain projects perhaps four to six months, but not the same in all projects. Remember, that was a $300 million cut. Last year it was a $1 billion cut. Now that was much harder to take, and that forced me to make a series of these kinds of decisions. I told you one group of decisions, the ones associated with directed energy systems. I approached it differently in other areas—

Mr. **Murtha**. In the first year, you had enough money to have——

General **Abrahamson**. I had a little carry through.

Mr. **Murtha**. Yes. But you didn't have enough to go forward fast enough that you could have all the information you would like to have had by the end of the first year.

General **Abrahamson**. That is correct.

The second year we made a series of these choices. I would like to point out to the committee, you can only do that once, you can only eliminate space-based chemical lasers once. You can't eliminate it again. So if we suffer a similar large cut of that kind, the implications are that we will have to go back and look and see if there are areas of acceptable risk.

But it will mean a substantial slide in the readiness date for coming back to the Congress for a decision.

Mr. **Murtha**. What would happen this year? For instance, you made the decision on which direction you are going in a number of programs. Will you then continue to narrow down the scope of the research, or is it just slowed down?

General **Abrahamson**. We would slow certain ones more than others in order to keep a reasonable coordination between programs, but it would probably be primarily slowdown, as opposed to choices. I can probably explain that best in one of the satellite programs. I indicated that we have to have eyes for such a system. One of the systems that is proposed to provide discrimination capability between decoys and warheads is what we call a mid-altitude satellite system; it is called the space SSTS. It is a tracking system, but it allows you from about mid-altitude to around 8,000 kilometers, or so, to be able to look back and tell the difference in these systems.

The original approach was to build a prototype kind of satellite, an experiment, but you would put it up, and test it. We anticipate testing that in the 1992 to 1994 timeframe. Faced with this cut, I decided to take the program and divide it into two halves. Most of the program I decided we would not put up in an experimental program in space, we would use a ground simulator. That ground simulator allows us to test all of the advanced calculations that you have to do, therefore alleviating the need to test in space.

However you must test the sensors, you absolutely must do that. So, as I said, I have reduced the program into two halves. It is going to make it all much more difficult to understand how effective that is because a future Congress is going to have to take a look at the results of a ground-based simulation and a series of space experiments on sensors, and make a development decision. But now it is a minimum because you just have to do the sensor experiments in space.

So I can't make any choices further in that kind of a program.

Mr. CHAPPELL. Mr. Dicks.

BASIC RESEARCH FUNDING

Mr. DICKS. General, you and I had a chance to talk a minute before the hearing, and I had a chance to go out to some of the labs and some of the contractors and get a better feeling for this. I must say my general impression was that there are some things that we can be doing in the near term on point defense and on defense against theater weapons in Europe, some of those technologies are relatively mature.

I also came away with an impression that for a lot of these other technologies, we really are a long ways away from being there. We are going to need to do a lot more in basic research. In fact, we are going to need a major technological breakthrough or quantum leaps forward in technology in battle management, for example, in computer chips, even in these laser technologies such as the free electron laser, et cetera.

These things aren't there yet. I am a little bit worried because, I get a sense that you are under pressure to tell the Congress a very favorable story, to pick out a couple of instances where you made some progress. But out of that comes the impression that we are almost ready to do something. I must tell you when I looked at this, it looked to me like there is a need for a lot more fundamental research. I am just a little bit worried we are rushing to these demonstrations, to these experiments, in order to garner public relation support both in the Congress and with the American people, to maintain the funding of the program. I worry this is at the expense of doing fundamentally sound scientific research to get these major step-ups in technology that are necessary in order to accomplish it.

Is that an unworthy or an incorrect perception on my part?

General **Abrahamson**. Well, I would like to start with the fundamental premise that you indicated, sir. Several of the things are indeed a long ways away, and there is a lot of infrastructure and important work that has to be done. I would agree absolutely that that is the case, but there are some things that are earlier, some that are later, and some fundamental things that are missing.

I am really concerned, if I have given wrong impressions about exactly what those are and what they can be.

[Clerk's note.—Classifed slide removed.]

General **Abrahamson**. Let me show you a couple of schedules, if I might, which I think are earlier, but begin to support what I have been saying. The first and most important thing I have been saying is that there is a decision that a future administration and a future Congress will have to make, and I still believe that there will be available in the early 1990's, enough information to make that decision. I have now tried to concentrate on what the character of that decision will be.

Here is an example. I showed you and I spent a lot of time going through the space-based kinetic kill program.

We are now in a concept definition phase where we have many contractors working ahead. I pointed out there is an important relationship between the fundamental technology program and this integrated system program. In fact it even ties into the railgun experiments, because that is part of a particular railgun.

But we will soon be making a selection in Phase II where we go forward with two contractors, and we do see, that if the fundamental technology is at all valid, we are looking at various technologies for space experiments out in the early 1990 to 1992 timeframe.

Well, that is the point in time when you begin to see if it works or doesn't work, and you have to remember there is a lot of other work that has to come along parallel to this work on countermeasures. For example, the work on the battle management and C3 have to come together at the same points in time so that you could make a decision to go into the second stage, full scale engineering.

Now, it may be that we are getting this impression because the character of the decision is not to say. "Deploy at this point." The character of the decision is to say, "Yes, we understand we can do it and, therefore, we ought to go into a hopefully reasonably aggressive and full-scale engineering development and deploy." I have said, quite consistently, I see that decision in the early nineties. If we have done our homework properly, the technology is there so that you don't have to have a decade of work for some of these other systems.

We did the F-16 in three years of development. We had it out. And that is possible, but it takes really an aggressive and well-thought-out research program ahead of time for an early deployment in the mid nineties.

This is kind of what I think we will all be looking at somewhere out here [indicating], and that is this early nineties decision. I don't think it will be one decision, I think it will be a series of decisions. Just like we make decisions on B-1s, and we make decisions on other aircraft or tanks. I think there will be a series of those kinds of decisions over time.

But the first one will be important one because that will have most of the political content. Are we going to begin to go into development production? Now that means that for at least the initial systems, I really believe that you have to have a very very good understanding of where you are. You really need to know what the threat is now and what it will be over perhaps the next decade, the decade of the nineties. You have to know how this is going to fit into a strategy and what the relations are between the proposed offensive and defensive systems. You can't go into a development on a "hope this is going to work out". In fact, with all of the research that you have done, you should have a specific design, a real contract that you can go after with specifics and technical confidence that you can get there.

I dealt with these particular problems of survivability, discrimination and countermeasures and have an understanding of what the costs are of the development phase and the projected cost in the deployment phase. I think we will have to know that for these early systems.

But that won't be enough, because that will only be a partial capability if you are trying to go up to this really fully capable system sometime in the future. That doesn't mean that you have to know that on everything, but you have to know there is a second generation that will be coming along. If the space-based kinetic kill vehicle and some of the ground-based ERIS vehicles are the first step, you would want to know if this free electron laser and that will make this more effective, more countermeasure resistant and more cost effective.

You may not need perfect understanding of this level, but you have to have reasonable estimates that it is coming and is going to get there. Three years downstream I think we will have some of that. So when you make this decision, you are a lot further along here.

Finally, you would also like to have some things in your technical pocket, projections for future innovative things that in case they go this particular way or that way, you can deal with them. But this really is a different strategy we are embarked on and that different strategy means that you are exploiting a whole technical river and pushing that along.

Now, we are not going to run over here in a three-hour briefing or a two-day session of the various committees and try to get across that level of confidence. It can't be done. It would be ridiculous to think that is going to happen.

Over the period of our experimental and research program, you have all to see, I think, our successes and our failures. You have to see how these are working out. You will build confidence because these are going to be the most complex decisions you have ever seen.

Within the ABM Treaty, you will have a set of tests here, a set of simulations here, a set of analysis here, and somehow that will have to be integrated so you will understand the meaning for a system. By the way, that is why we are placing a strong emphasis on the National Test Bed it will be used as a simulator of the overall system.

So, I am trying to conduct as open a program as possible. I am trying to get across to everybody associated with this program, what the total scope is, and the importance of some of these kinds of developments. Yes, you will see the failures. I have told you about those and will continue to be candid.

When we had our first rocket flight up and it didn't work, we came and told you about that. A lot of it is working, and that is good, but we are not saying it is here tomorrow, we are not saying that at all.

Mr. CHAPPELL. Mr. Miller.

BASIC RESEARCH FUNDING

Mr. MILLER. Thank you, Mr. Chairman.

Earlier this week we heard testimony from representatives of the Institute of Electrical and Electronics Engineers who expressed concern that the technology base portion of DOD research funding was not adequate to provide the advances and breakthroughs that will be needed for the next generation of defense systems. Meanwhile, they pointed out that there was a great increase in funding for the advanced technology development portion of the DOD research program, and that this was due primarily to money earmarked for SDI.

We have repeatedly heard that SDI is a research program. However, when I asked the IEEE witnesses whether they thought that the SDI program would enhance the technology base, they replied that SDI was not really supporting basic research. They said it was really an applied technology program, and that its primary focus is on systems engineering using existing technology.

Do you have any comments on that? You may wish to address that issue briefly now, and then answer more fully for the record.

General ABRAHAMSON. We are doing a great deal of basic research. I can't comment on IEEE and what its representative was referring to specifically. But in the SDI program we are funding a mixture of both applied work and fundamental work.

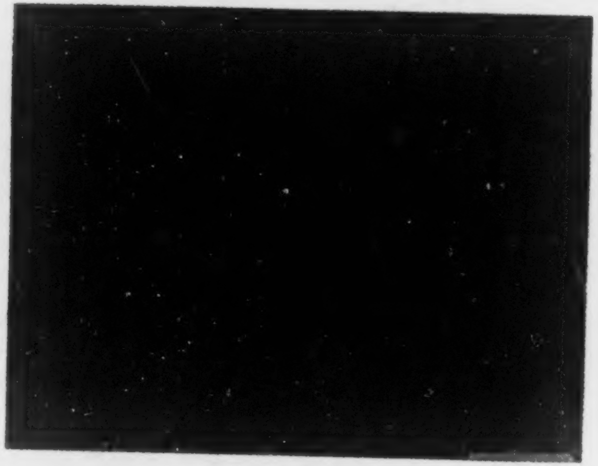
An example of the basic work is the invention of that impurity band conductor type of IR sensor and applications in software on how we are going to tie together parallel processes. That is a whole new area of basic fundamental research that is going on in many places. Now whether or not that is the area of either interest or expertise that IEEE can offer, I am just not in a position to answer. But I can say I would be delighted if they can contribute to the program, to have them come and talk to us.

TECHNOLOGY SPINOFFS

If I might, sir, I would like to show you that there are spinoffs that are beginning already to happen in defense programs. I think we are funding totally now the Department of Defense efforts on gallium arsenide circuitry, and we have two production lines on gallium arsenide. Gallium arsenide is the next generations of basic chip material for computers. Today in our watches and in our computers we use silicon. Gallium arsenide is about five times faster and it is radiation hardened, so it is of great interest to us. In all countries in the world that are working on chips, there is both in government and in private industry, research goinng on in gallium arsenide. But we have the only pilot production lines now operating, a pilot production line at Honeywell and one at Rockwell, and we are negotiating with McDonnell Douglas to set up a third one. Here is just a picture of one of the processes in this pilot production line.

[Slide follows:]

SDIO/DARPA MESFET PILOT LINE



- PILOT PRODUCTION CAPABILITY ESTABLISHED FOR GaAs LSI DIGITAL INTEGRATED CIRCUITS
- 4K RAM AND 2K GATE ARRAYS DESIGNED FABRICATED AND TESTED
- 16K RAM AND 6K GATE ARRAY IN DESIGN

General **Abrahamson**. Now, this is very basic, but we are researching how to bring down the costs. We are not going into production on any of these weapons. We are looking at how you can create new quality assurance techniques so you can know this new material works. We now have some of our arrays from this line that we have now developed that are going into a classified Navy program. It is an important one for the Navy. But it is an application of some of the research into a program which is the reason they are interested in it. They have to run a computer for a long period of time off a battery and it is part of a communication node in the Navy sonar net. It is a mine they dump out in the water and it takes signal from all over. So we are delighted some of our work is beginning to pay off in other areas. That is an example of it.

Mr. **Miller**. In another area you were showing us some of the gyros, and presently we have in our Minuteman guidance system those gyros sitting there running hour after hour after hour and then a repair needs to be made on the whole unit or the unit replaced. You spoke of one in particular, the laser with a triangular action where you would not have the moving parts. How close are we to using that unit in the guidance system of the Minuteman or on the MX?

General **Abrahamson**. I will have to get that answer for record, sir, since I haven't been following that actively. I know the issues. When you want to go back and put new technology in old airplanes or old systems, obviously it is always a tradeoff between what the cost of putting in that new technology and buying the new units over the projected repair rates over the next few years for the old systems. You are right, ours are always operating and spinning that way. I do not know what kind of tradeoff the Minuteman logistics managers have made. But I will get you that for the record.

[The information follows:]

It is my understanding that the triangular action laser gyro you are referring to is being considered as one of the three competing navigational systems for the small ICBM. It is not being considered for use in the Peacekeeper missile.

Mr. **Miller**. Thank you.

Thank you, Mr. Chairman.

Mr. **Chappell**. Mr. Hefner.

SPACE TRANSPORTATION REQUIREMENTS

Mr. **Hefner**. Thank you, Mr. Chairman.

I would like to touch a little bit on the transportation part. SDI's Phase 1 system architectural studies conclude SDI will require the transportation of up to 200,000,000 pounds of equipment into space. Now, this would require up to 5,000 space shuttle launches. To be affordable, cost per pound to lift this material in orbit must be reduced from $3,000 to around $300. If you agree with this statement——

General **Abrahamson**. I don't.

Mr. **Hefner**. You don't, you just discount that. So you——

General **Abrahamson**. No, it is very important. What I discount and don't agree with is the particular estimate of the amount of hardware that has to go into space. Obviously some of the initial studies did outline very, very high numbers. That was one of the reasons we began to do the work on the tradeoff studies. It is also one of the reasons that pushes me in the direction of the ground-based free electron laser in our initial directed systems. Because it is quite clear that space-based lasers—and there are other issues as well—will cost us a great deal to get them up and in position. There are some advantages as well. So we are always working to try and minimize that. Obviously where I showed you we are working to try to bring kinetic kill vehicles from a weight today, each one on the order of 800 pounds, down to the order between 130 and 150 pounds is again the same thing. Nonetheless, even with those efforts to try to bring down the weight one would have to lift into orbit, it is imperative and very important that we do bring down the cost of space transportation. You are very right. So the issue you are aiming at is a proper issue.

We have been in a study that has been going on now with the Air Force and with NASA for a full year, and a report is in the process of being written and delivered to the Executive Office. The intent of that report is to identify which technologies will lead the Nation to a vastly reduced cost of space transportation, not merely for SDI but for all of our objectives.

Mr. **Hefner**. Just last year, you just talked about affordability as a key factor. This year SDI has allocated $11 million, less than 1 percent of the budget, to this area in 1986. Why such a low rate of funding?

General **Abrahamson**. Primarily because what we are doing at this point is making some important decisions with the other space transportation agencies on what areas to invest in. This study is laying out a technology roadmap, and the study is just about complete. There are still some interagency decisions to be made. One of the areas of those decisions is the aerospace plane that was announced, and we will be ramping up in our funding for the basic technology research, not only for that one but also for other areas as these decisions are made.

So the problem isn't that it isn't important; the problem is we hadn't made the right choices about which technologies to invest in.

Mr. **Hefner**. So the next question, assuming a base of 58 million pounds of space-based equipment, you require about 23 years to put it in place?

General **Abrahamson**. I don't accept any of those numbers. We are trying to drive all those numbers down to something reasonable.

Mr. **Hefner**. I understand that. But my concern is that I don't understand all the technology and all the technical aspects, but I do vaguely understand the problems of the transportation and putting it into place. My concern is that we go ahead with the Star Wars aspect about the lasers and we get to the point where it goes into space, then we look back and say we have a bill of $100 billion just for transportation. This gives me some concern because in my mind I can barely understand this part of it. The rest of it is absolutely Greek, and no offense to any of my colleagues, but I don't understand a lot of these. However, I do understand the numbers on the budget and the costs we are talking about. That gives me some cause for alarm about the transportation problem.

General **Abrahamson**. Sir, your concern is absolutely correct. The cost of space transportation, not merely for SDI but for many of the objectives of this nation, has to be brought down. We just set an arbitrary goal of a reduction on the order of 10 to 1 in terms of cost for space transportation. Our problem has been to decide which technologies can really lead to those kinds of reductions, then to invest in the research so that can indeed become a reality. And then at an appropriate point, based on that research, start those system programs. I absolutely agree with the point you are making. The only thing I would like to say is that it is not something we are ignoring. We are tackling it two different ways: one is to find the right place to do the research to bring down the cost of space transportation. The second way is to try to reduce the total load that we have to take up there. So I don't disagree at all with your concern.

Mr. **Hefner**. These estimates we got are from your own people.

General **Abrahamson**. I know. You have to remember what the character of our architecture studies are. Our architecture studies are a series of groups of people, some of whom are advocates of space-based lasers and others advocates of other systems who have put up, and they are doing tradeoffs. One of those tradeoffs is the cost of space transportation, and in fact it is probably a principal parameter of the cost of an essential system, so what they don't have in every one of those things are our efforts to bring down the weights of these systems. This will be an ongoing effort. What I am trying to underscore is that while some of the concepts, early weighting estimates, do show those numbers, I haven't accepted any of them and I have set goals much lower.

Mr. **Hefner**. I guess what I am saying to you is, that we get so carried away with our Star Wars, we forget about transportation, and we come to a point where we find we have a system and it is so expensive we can't afford to put it in space.

General **Abrahamson**. It is a valid concern and a right concern. That is why we are doing it as systematically and responsibly as we can, by first making a national decision on the overall space transportation requirements structures, and which technologies will be the right ones, and then to allocate money against that.

Mr. **Hefner**. You have an estimate of 20 billion pounds to 200 billion. That is a pretty big range. I say this is optimistic. So I just have these concerns.

General **Abrahamson**. It is valid.

Mr. **Chappell**. We stand in recess for about three minutes until Mr. Livingston gets back.

[Recess.]

BOOST PHASE SURVIVABILITY

Mr. **Dicks**. One issue that came up when I was out is a problem of survivability of the boost phase intercept. For whatever system we are talking about, there is a question of its being able to survive a Soviet attack or Soviet countermeasures. Why don't you tell us about that in light of what the possible threat might be, or countermeasures might be. Secondly, there is a battle management command and control question. In other words, how soon are you going to have release from the national command authority in order to make boost phase credible?

General ABRAHAMSON. The whole problem of ASAT—and what we are talking about is Soviet capability to intercept and destroy the space-borne parts of an SDI system in the future—is much more complex than many of the views that have been laid out here.

[Chart 8 not available.]

This chart shows where our various systems are now and their altitudes.

We would probably have a set, a number of layers of systems. The first layer might well be between 1,000 and 2,000 kilometers high, and that means we are talking somewhere on the order of the range of about 400 miles for some of those first kinds of systems. What would they be? They would be space-based kinetic kill vehicles probably. Now, they can destroy a booster on the way up or if that booster is carrying an ASAT, it can be a self-defense weapon as well.

They would probably be deployed in layers, and you would place them in an optimum position, where they would cover the earth. They would act as interceptors and protectors; intercept missiles but also to protect the key discrimination satellites. Your battle management satellites that are going to be out farther. Remember I said this SSTS satellite was somewhere around 8,000 kilometers ———.

There are several different ways these can be destroyed. The current Soviet co-orbital plane—this chart may be confusing because the range is not linear—shows a long way just to get out to ——— kilometers and suddenly all the way out here to ——— is just a little bit farther. Notice the scale is different. It is nonlinear.

[CLERK'S NOTE.—Classified slide removed.]

Mr. DICKS. It isn't just an ASAT capability?

General ABRAHAMSON. That is correct.

Mr. DICKS. They would use their ballistic missiles against us———

General ABRAHAMSON. Absolutely they can, and that is the point I would like to make. Right now, today, their corps of interceptors can get out and this has been demonstrated in some of these low-altitude ranges, so here is what we think those can do. On the other hand, an ASAT, if it were diverted so it wouldn't be a ballistic missile, would go up in the air and use its nuclear charge to destroy the satellites in space instead and can reach out a very long way. We consider that one of the very powerful and straightforward kinds of systems they might use. They would take some of their very large boosters, ballistic missiles, and reprogram them in such a way they would set off a nuclear charge in space. Therefore we begin to worry and to deal with how does one handle a ballistic missile attack, a nuclear charge in space. There is a tradeoff that goes between the hardening of the electronics. Remember you are not going to have to deal with an explosion; an explosion occurs in the air. What you are going to have to deal with is a radiation pulse, and that is what will destroy it. There are some curves that say if you have a very large bomb like ——— and you haven't tried to harden your detectors or harden your electronics, you must always stay ——— away from the bomb. Otherwise you will destroy the electronics.

Well, we have lots of techniques by which we deal with that right now. Our own ballistic missiles have hardened electronics. Here is a hardened scheme for silicon, by the way, that is built around a computer scheme that's being laid out at Livermore. This computer scheme shows you the power of today's computers. There are fairly standard computer chips. This is about the equivalent of an early Cray computer. Remember the Crays were not to be the big important things in the early days? This, instead of being surrounded by plastic, primarily by Tamplin, which is an absorbing material for radiation. It would have special radiation traps around different areas. So this is at least one key concept to be able to begin to build electronics for satellites or other systems where you would harden around today's silicon type of electronics. The other one I showed you——

Mr. DICKS. We don't have that today?

General ABRAHAMSON. Sure we do.

Mr. DICKS. On our satellites today?

General ABRAHAMSON. No.

Mr. DICKS. Those we have up there today would be vulnerable?

General ABRAHAMSON. That is right, today's satellites would be vulnerable. However, we do this kind of thing on all our nuclear weapons, so that is not unusual technology. However, if you recall, I said one of the very important areas of emphasis was taking our detectors and our chips and moving into gallium arsenide, trying to get radiation-hardened systems. What happens is they have to get the bomb much closer to destroy it and now you have a tradeoff, now you can begin to maneuver.

RELEASE AUTHORITY

Mr. DICKS. The second part of my question, was what is the command authority release from the national command authority? In other words, for boost phase intercept, we are going to have a decision rather quickly to make it a possibility. Tell me about that, what is your thinking about that at this point?

General ABRAHAMSON. That is a philosophic question more than a specific technical question we are working on now. My initial reaction is that if you have a signal that there are one or two or a small number of what appear to be ballistic missiles heading towards our own shores from someplace, if you have a partial system in place, or even just an initial capability, you can probably afford to sit back and wait if you have confidence in that system, wait long enough to be sure, mabe even longer than we can today. Remember today the President has less than about six minutes to make a decision. The character of his decision is, "Do I unleash my ballistic missiles against the Soviet Union?"

The character of the decision that he would make here is, "Do I destroy these ballistic missiles which are headed towards us, not threatening any person, not using a nuclear system, not using anything except something that doesn't threaten anybody on the surface of the earth?" A very different kind of decision.

As I indicated, if it is only a few, you can probably sit back and wait, you might even have time to communicate with the other side and say, "Is this a space launch that's gone awry or something like that?" If on the other hand it is a thousand ballistic missiles rising out of the Soviet Union, the President doesn't need to ask anybody, and so long as you have confidence that that's your real signal——

Mr. DICKS. You would be for pre-release?

General ABRAHAMSON. I believe what you would do is set up, as we do now, a series of defense conditions, and those defense conditions would probably have different pre-release concepts on them. And since you are, again, not dealing with nuclear weapons that are going to destroy anybody on earth, they are only going to react to a system that's fired, it is a very different kind of condition.

Mr. CHAPPELL. Mr. Livingston.

SCHEDULE OF SDI

Mr. LIVINGSTON. Thank you, Mr. Chairman.

General, Mr. Dicks may have referred to the schedule before rather than the merits. Specifically, Senators Proxmire, Johnston and Chiles wrote a report and concluded:

> . . . the schedule-driven nature of the current research program has aroused significant concern among scientists at the national weapons laboratories. The concern is twofold. First, promising long-term research will be compromised to reach an arbitrary schedule. Second, in an effort to maintain public support for high funding levels and an early development decision, SDI experiments will degenerate, in the words of a senior scientist at the Livermore National Laboratory, into "a series of sleazy stunts".

Would you comment on that?

General ABRAHAMSON. Sure. This is a free country and we have people, all kinds of people available at these various places—some of them don't even work on the program—who are free to comment on it. If that's the way they see it, they probably would comment on it. I have no doubt there are some people concerned about that and some people who are either for the program or who are concerned with the long-term nature of their own specific project that they might make those kinds of comments. Now, I don't believe that's what we are doing at all. I think in fact what I tried to lay out here is a very systematic program that is in fact very scientifically based. However, I am putting pressure on the schedule. I am putting as much pressure as I can on everybody out there because I think that's the way to both save money during the research phase and to try to have the decision available to the nation if we need to make that decision early or if we need to make it as soon as it can be there. I am following the rule that says if you want to save money do it faster. I have a highly competitive program and some of the ones who are losing in that competition for funds are losing not so much over time. If it is a slower program but a promising one, it will be funded at a lower level when I have to make choices here, because of the funding level.

I have no doubt that was probably said, but I don't think it represents the way the program is being conducted.

Mr. LIVINGSTON. Yet the Fletcher panel concluded that an SDI program which is not constrained by funding would bring into being a system by the 1990s. I understand even though Congress is restraining your funding, that you are still saying there will be a system in place sometime in the 1990s. Is that correct?

General ABRAHAMSON. I have indicated I believe that we have had to make some very tough decisions with the funding-restrained program that we have had to operate under. Up until now we have still been able to preserve the option of making this decision in the early 1990s. We should be able to have a development phase that you could then go through, an aggressive development program, and begin to deploy in the mid-'90s time frame. That is for the initial capability, and it doesn't mean you are going to have this robust system right in the very beginning.

If there are continued cuts in the program, as I indicated in an earlier answer, I believe that I am running out of options to make early choices between different technologies and that it will now have a much bigger impact on the schedule in the future.

Mr. LIVINGSTON. Thank you.

Mr. CHAPPELL. General, thank you very much. And if it is all right with you, we will come back at 2 o'clock. The committee will stand in recess until 2 o'clock.

AFTERNOON SESSION

INTRODUCTORY REMARKS

Mr. **CHAPPELL.** The committee will please come to order.

Gentlemen, we will proceed and pick up where we left off this morning.

X-RAY LASER DEVELOPMENT

What about the X-ray laser; how do we stand on that?

General **ABRAHAMSON.** ———.

Mr. **CHAPPELL.** Tell us what you can.

Can you tell us generally where you are?

General **ABRAHAMSON.** I can tell you some things. It is one of the projects, and I think it is important to reemphasize the President has directed we try to make the Strategic Defense Initiative nonnuclear if at all possible. Just like we have been proceeding with and trying to understand what kind of countermeasures that the other side could utilize. For example in lasers, we are not only developing lasers, we are developing laser armor and trying to make a determination would it be practical to implement that armor, and at what level, on some of the missiles. If that were the case, what would it do to the missiles? In fact, I can show you a chart on it. ———.

Mr. **CHAPPELL.** Let me be sure—we are at the secret level here, right?

General **ABRAHAMSON.** I'll operate at the secret level. I think we ought to take the chart off because it has some restricted data elements in it. I think I'm aware of clearances with the DOD; clearances where I'm not confident is the status of all of the staff members.

Mr. **CHAPPELL.** Let us do this, let us wait until the very last and we will be sure of all the clearances and then we will come back to that. The airborne optical adjunct is in the same category, isn't it?

AIRBORNE OPTICAL ADJUNCT

General **ABRAHAMSON.** That was the project that I did go through in more depth. We are very pleased with the progress of that project. It hasn't been all success. In fact, we initially started out with two basically different infrared concepts and two different infrared focal plane manufacturers. As one of them developed difficulty and trouble, rather than continue to fund them and have a very large overrun or the potential of a large overrun, we took very prompt action and just cut it off. Now we are proceeding with a single focal plane developer.

Mr. **CHAPPELL.** Mr. AuCoin.

SOVIET RESPONSE TO SDI

Mr. **AUCOIN.** Thank you, Mr. Chairman.

General, let me say it is good to see you back before the subcommittee again. As usual, you have made a cogent presentation on a subject which we do have some differences of opinion. Most of the public debate on SDI has centered on feasibility and cost, and I'm concerned about that as many Members are. But what concerns me most I think is this: suppose you solve all the technical problems and suppose once those problems are solved, the Russians end up doing the same thing in space-based strategic defenses as we do. Where then would we be in terms of our relative stability between the two superpowers, each with a Strategic Defense Initiative?

General ABRAHAMSON. I think the key to the answer to that question, sir, is with the confidence that both we and they would achieve, that a prompt nuclear strike, which is of course what the ballistic missile offers any military planner, is just not a feasible or a workable option. Then I believe we are in a situation of greatly increased stability, particularly in terms of a crisis, and I believe that was the fundamental objective and one of the most important motivations behind both the President's speech and the basic thrust of the program.

Mr. AUCOIN. You think stability would be increased even if both sides had a strategic initiative?

General ABRAHAMSON. Yes.

Mr. AUCOIN. It would seem to me if both sides had an SDI, an advantage would be given to that side possessing the one that decided to go first and would use that so-called defense in an offensive way. The advantage would be with the aggressor rather than the defender.

General ABRAHAMSON. Well, right now I think it is quite clear that the advantage is with the aggressor. In fact without any defense at all, and particularly as the relative balance between the retaliatory capability that we can utilize to threaten their military capability and the capability that they have to threaten ours, it becomes quite clear that the advantage is with the first strike.

As our present offensive forces become less and less viable in terms of being able to ride out and strike on a second strike mode, then we are forced to begin to consider some of the things that even some of our people in the program have advocated such things as launch on warning. Those are very destabilizing in my judgment.

TRANSFER OF SDI TECHNOLOGY TO THE SOVIET UNION

Mr. AUCOIN. If we were to sell or even give our SDI technology, once we developed it, to the Soviets, what is the probability that we would be giving them the very means it would take to defeat our own SDI?

General ABRAHAMSON. I think that has to be very carefully examined and I think that the assumption often placed on what the President indicated when he said that we could share technology is that we would go over and show them how to build it, we would do it and put it in place. I believe that there are many other kinds of options in terms of sharing that a wise administration and a United States that was clearly ahead in the development of strategic defenses could use effectively in many arenas, certainly in the arms control arena to try to effect further reductions in offensive forces. In the end, the real stability in this question of being able to bring down offensive forces while you are raising and increasing your defensive capability.

Mr. **AuCoin**. Let's go back to the question of what happens to our own SDI capability if we were to sell or give SDI capability to the Soviets. Isn't there a high probability we would be giving them the means to defeat our own SDI?

General **Abrahamson**. No. I think that would have to be a fundamental part of the examination in terms of what it is that you would share and how it would be shared. I know it is not good to argue by analogy, but when we were searching for stability in the Sinai between Egypt and Israel, after the last war of attrition, one of the concepts was to put in place a warning capability. That warning capability would opt for either side in both directions. In a sense that is sharing of a warning capability.

Mr. **AuCoin**. That doesn't fit my description of SDI.

General **Abrahamson**. No, I understand that. But what I am trying to offer here is that I think there are a range of options that if we were ahead in such a process we would use these options quite differently and could use them quite differently to try to further our improved security in a world situation.

Mr. **AuCoin**. Are you saying, then, that in sharing or selling SDI technology to the Soviets we would not sell them anything that would represent weaponry?

General **Abrahamson**. No. I am trying to be rather non-specific, sir.

Mr. **AuCoin**. You are doing an excellent job.

General **Abrahamson**. I am not trying to evade the question. All I am trying to say is that in implementing that idea, one has to consider very carefully what it is you are giving and how they might use it.

Mr. **AuCoin**. Tell me why that is the case. Why is that?

General **Abrahamson**. Let's say——

Mr. **AuCoin**. Why is that so sensitive?

General **Abrahamson**. Let's say if we were to give them just our very best computer technology, they would probably not utilize that only in an SDI. They may utilize it in many other military applications to our very substantial disadvantage, and that is why I think it has to be looked at with a broad view. On the other hand, you may well be willing to share warning, you may well be willing to do some other kinds of things if the price is right, if the price would be giving up a substantial number of offensive missiles on both sides.

Mr. **AuCoin**. Can you, as of today's hearing, indicate to the subcommittee any envisioned component of [illegible] weaponry that could on a stabilized basis be [illegible] represent some form of threat to our [illegible]

General **Abrahamson**. And not [illegible] to our own SDI?

Mr. **AuCoin**. Yes.

General **Abrahamson**. I cannot [illegible] tee, and I apologize. It falls in the [illegible] have given to the President and we just [illegible]

Mr. **AuCoin**. Is that because of the [illegible] right now?

General **Abrahamson**. Just as the [illegible] and, providing advice to the President on [illegible] not be [illegible] acted on. That's privileged communication between the Secretary and the President. I am trying not to be just withholding things from you, I'm just trying to say that there are capabilities and there are areas that I think at the right time, in a proper way, might be used. But certainly because I think the President has made a genuine offer.

Mr. AuCoin. Are you describing some form of executive privilege?

General Abrahamson. I am saying I am uncomfortable in providing that until I know the merit of what we have talked about.

Mr. AuCoin. The merit of the recommendation made to the President?

General Abrahamson. Yes.

Mr. AuCoin. Let me move then to something else. I have been trying to determine the merit of the whole program.

General Abrahamson. I understand.

SPACE MINES

Mr. AuCoin. We talked about space mines before in your appearances before our subcommittee. I suspect by now you are tired of hearing about it. Notwithstanding that, let me for the third year ask you some more about them. I haven't heard an answer yet on space mines that gives me a great deal of comfort. Suppose the Soviets get SDI technology comparable to ours and they use it to build space mines and they strike first, and use their space mines to take our defensive system, our satellites, out. Then they shoot ICBMs simultaneously. How do we defend against such a scenario?

General Abrahamson. There are a range of defenses. Let me use this one.

Mr. Chappell. Would you speak up just a little bit?

General Abrahamson. I have described them in the past. Obviously you would like your defense to operate in such a way that you have a range of options so that the range of options would not exacerbate a crisis, and you could use it to show resolve or you could use it in a very effective nonthreatening manner. So you want to look for both of those. I have indicated to you that in the past, that a very interesting kind of concept is a tethered satellite. A tethered satellite concept is one that has the weapon or the other key elements of such a system at the end of a very long tether. So long as it exceeds the range of effectiveness of a nuclear burst, then you have a dynamic situation.

Now, those dynamics are very hard to duplicate for a "space mine." He has to either come up and tether himself in exactly the same way——

Mr. AuCoin. Are you sure it would have to be exactly the same way?

General Abrahamson. If the range of the rotation, which you can change with very little energy, by the way, would exceed radius of destruction due to the radiation from a nuclear burst, you could avoid the problem and he would never know which of the two or the three satellites that he is dealing with. The nonthreatening way you deal with that is you just run them out of fuel. You do that very easily with that kind of system. You put decoys up. If you could put decoys on RVs—and the critics in general think that's a very potential effective use against an SDI—it is my claim that if those are at all realistic we can do the same thing and we can run them out of space mines. It becomes then, an economic way that you can deal with it. Now, in addition to that, there are other kinds of concepts that we can use. Finally, there are a whole range of other options. There are electronic warfare options.

Mr. **AuCoin**. Shoot back?

General **Abrahamson**. Electronic warfare. Which is not necessarily shoot back. If it is going to navigate very close to a target, one of our SDI satellites, it has to do one of two things, get a signal and bounce it off a satellite and stay in formation. Any time he is trying to navigate off of you, you are in a situation where you can interfere with that navigational signal. We use electronic warfare for airports. Or he could wait and get his signal solely from the ground, and under those circumstances he is much further from the ground than he is from you.

Therefore, the fundamental power of equations for all electromagnetics are in your favor and you should be able to interfere with that signal. Now, those are passive means. Finally, you can shoot back.

LONG-TERM SDI UPGRADES

Mr. **AuCoin**. Some SDI advocates believe that once we build—if we do—a capable SDI, we can just stop right there. That is, if the Soviets build one after we do, that it's just as good as ours. Or if they progress and build one a lot better, that's basically okay because we will still have a Strategic Defense Initiative, a shield of some kind that adds a great deal to the risk of a ballistic missile strike. Do you agree with that concept or do you feel our defense has to remain better and kept better than the other side's?

General **Abrahamson**. In any of our strategies or the way we then implement those strategies with troops and with armor—I think that our forces are clearly different. Therefore, I believe a Soviet SDI would take a different turn than something that we might propose. For example, they would not be so concerned with trying to defend populations as we might. That might mean they would have a very different system. I do believe, however, that just like the history of all warfare and weapons, that there would have to be a continued effort, just as they would mount a continued effort to try to find a weak spot or countermeasure or begin to try to solve such a problem. There is no such thing as an ultimate weapon of any kind in my judgment.

Mr. **AuCoin**. So you see the countermeasure and counter-countermeasure proceeding in the area and sphere of strategic space defense in the same manner we have seen it elsewhere?

General **Abrahamson**. Yes.

Mr. **AuCoin**. Mr. Chairman, I have other questions I will reserve.

General **Abrahamson**. The first issue is to continue and obviously conduct the experimental program for those nine flights. I have asked General Wall, who is the commander of the Army's Strategic Defense Command and who carries out all of our work within the Army and who is responsible for the FLAG program to come back to me now with a plan for the next logical step in exploiting that technology in such a way that it can be used more effectively in a theater-type defense. He has not done that. He is working on that at this point in time.

Mr. CHAPPELL. Mr. Dicks, I don't think you were in here. We agreed that on some of these questions it will take further clearance and at that time we will clear the room.

Mr. DICKS. When will you do that?

NUCLEAR DIRECTED ENERGY WEAPONS RESEARCH

Mr. CHAPPELL. We are almost ready to do that.

You asked for a transfer of certain funds from DOD to DOE for nuclear work. Can you tell us anything in an unclassified way we can use? If we get to the floor, we know there will be an amendment offered to knock that out. Can you tell us the purpose of it, what it is for, why the transfer is necessary?

General ABRAHAMSON. The transfer is necessary because what we have seen is that the potential of some of the nuclear concepts appears to be very, very powerful, at least theoretically, and some of our underground tests, have indicated they could potentially be used effectively against us. Since, for example, the X-ray laser first came to the attention of this country in Soviet literature back in 1974, and ——— they could indeed be working in the X-ray laser area, it is very difficult to judge for sure or how far they are going. It does suggest that it is a prudent course to understand where that technology could go. And since it could have a very profound effect on the structure of how we might produce an SDI, we felt we should proceed as fast as possible to examine its full potential. The transfer of $62 million was in recognition of the responsibility the Department of Energy has in the nuclear weapons arena. This responsibility is indeed different from what the DOD can do with the laboratories on a reimbursable basis.

We thought the legal way is to come to the Congress and to ask for the transfer of funds. The intent is to accelerate the underground testing in several areas, not just the X-ray laser, also the Prometheus concept, and one other.

Mr. CHAPPELL. Is that to be used as a source of power for one of the other systems?

General ABRAHAMSON. I think the right way to consider this is to recognize—and it is probably unfortunate that this is associated only with SDI—that what has happened here is that the world is now really on the brink of the third generation of nuclear weapons. They are of a different character and that has implications not only for an SDI system, it has implications for our strategic forces, if the Russians develop an X-ray laser, for example, or some of the other nuclear concepts. Therefore, it is important that we understand that for both our offensive forces and our defensive forces.

IMPACT OF SHUTTLE DISASTER

Mr. CHAPPELL. What is the impact of the shuttle disaster on your program?

General ABRAHAMSON. First of all, of course, I think it is a national tragedy and it has had a very profound effect on me since I knew that crew very well. The first thing we have done is we have lost, for perhaps a two-year period—we are not sure—an initial flight that was to have taken place in July of this year out of Vandenberg Air Force Base. It was called the Cirrus flight. It was an unclassified scientific flight, and the intent of it was to understand better what the atmosphere looks like from space in various wave lengths, heat-seeking infrared and ultra-violet as well. The satellite is completed; it is all ready; it was built out in the University community of Utah by some of the best atmospheric scientists in this country. The intent was to be able to look down from the bay of the shuttle and to examine over a period of time the upper atmosphere, particularly over the poles, and of course hopefully we would get an aurora as well. Through some good management, prudence and some effort, we have at least minimized that effect because we had a rocket program called Spirit, with some special—but certainly not the full instrument array that was available here in the shuttle fight. Approximately 10 days ago we sent a crew up to Vandenberg for three months with this Spirit rocket flight waiting for just the right aurora, and we got it. We have some initial data from this. It is only just a one-time shot. It doesn't obviate the need for the shuttle experiment but it does help us in the short period. Here is a picture of the rocket, and it had in the back an I.R. system and photometers and long-wave infrared imaging systems. This allowed us to get this kind of data. Here is I think perhaps the first space-borne picture of an aurora, northern lights, in the infrared, which of course we are getting as unclassified data and it will be available to the scientific community.

Mr. CHAPPELL. What is the significance of it?

[CLERK'S NOTE.—The slide originally provided by SDIO was not clear, therefore, it is being printed as page 670.

General ABRAHAMSON. The significance of this to us is we must understand just what the whole range of phenomenon is. It would really be a tragic omission on our part if it were quite clear that the Soviets would just have to wait until there was a lot of northern lights activity, and they could launch up through that and it would turn out that our systems would not be effective against that general background. So we are trying to take a very complete look and understand how one would utilize this. I think it is an example of not taking the whole issue lightly.

Mr. CHAPPELL. Thank you. Mr. Dicks.

ABM TREATY AND SDI

Mr. DICKS. The President has repeatedly stated the SDI program would be conducted in conformance with the ABM treaty. Your testimony reiterates this commitment. However, there is some debate over the precise impact of ABM treaty restrictions on advanced technologies. While the President has pledged to observe the so-called restrictive interpretation which has been U.S. policy since the ratification of the agreement, he has also acknowledged there is a justification to hold a view only limitations on advanced technology occur at deployment.

In your 1985 report to the Congress, you contended that all planned activities in SDI would be in conformance with the ABM treaty. At that time the only interpretation being discussed was a restrictive interpretation. Has there been any change in your program that would now violate the restrictive interpretation of the ABM agreement in your judgment?

General ABRAHAMSON. No, sir.

Mr. DICKS. According to recent reports in the press, you have now been directed to examine what you might do if you were allowed to use the interpretation that only deployment was restricted. What is the status of such a study, and when might it be completed?

General ABRAHAMSON. Our responsibility is to provide just periodic reports, and we are now looking at that and we have not yet provided the first of those to the President.

Mr. DICKS. Based on what you know today, what demonstrations will you consider including in the SDI program that are not in compliance with the ABM treaty as interpreted up to this point?

General ABRAHAMSON. We have not arrived at that kind of a judgment. Certainly there are examinations that have to be looked at and as I indicated, they have not been presented to the President, and we haven't even come to our own conclusion yet on the advantages or disadvantages of exactly that. We believe that in fact there may be some efficiencies in the program, if you are allowed to go on a broader basis. But that is only conjecture yet and has to be carefully examined in terms of a specific set of tests and then examined by the treaty committees that look at us and make the judgment about compliance.

Mr. DICKS. Have you felt restricted in any way so far in doing the research program? Have you had to limit certain activities because of the ABM restriction?

General ABRAHAMSON. In the early years—remember it takes usually several years to develop one of these things and bring them to the point of tests—I don't believe that we have had any significant restrictions. On the other hand, we started right from the very beginning of the program and designed the test around the treaty. One really needs to think through is if that were not started with that fundamental ground rule, would there be a different outcome? It is premature to judge what that is.

Mr. DICKS. So there are no demonstrations at this point that you would consider including in the SDI program that are not in compliance with the ABM treaty as interpreted at this point?

General ABRAHAMSON. That is correct.

Mr. DICKS. Would such demonstrations be critical in order to allow a development decision?

General ABRAHAMSON. I think the key point here is a very important, and subjective question. It is a difficult question: "what level of confidence and information would a Congress in the future and an administration in the future want to be able to make that judgment?" Remember I indicated I thought this was going to be the most complex decision anyone has ever faced because it is a series of analyses and things that must be added together, simulated, test results digested. Then that allows you to make a judgment about feasibility. Certainly it is not the kind of a thing when we had the F-16 program; you flew the F-16 and you said; "Does it work?" The key question is what is an acceptable level of confidence for such a decision? And we are just wrestling with it. That's the basis of my earlier chart.

Mr. DICKS. The ABM treaty is up for its five-year review next year. Is the proper interpretation of the treaty restrictions on advanced technologies an issue that should be reviewed in this process? In other words, if the United States and the Soviet Union sit down and reconsider the ABM treaty in light of these new technologies?

General ABRAHAMSON. I think that's a policy issue I would like to answer for the record, please.

[CLERK'S NOTE.—See page 626 for a response to this question.]

SOVIET ABM CAPABILITY

Mr. DICKS. On the question of defense, one of the things that we didn't have was a threat briefing this time. You talked a lot about Soviet capabilities in the past and trends. What are current intelligence estimates of our ability to deliver weapons on targets in a retaliatory response in the Soviet Union? In other words, how effective would the defense the Soviets have today be against our retaliatory forces?

General ABRAHAMSON. I think you have to look at several things. First of all, if their defenses continue to be only the partially effective interceptors around Moscow, we can calculate how it is you would overcome that. If, on the other hand for that capability, they were to exploit what they have been building into a command and control structure around the entire central region of the country, if they chose to put a larger number of weapons out and to defend their sites or their cities, that would change that equation very dramatically, and that could be done quite easily and quite quickly.

I don't have any intelligence indication they are doing it, but I think it is important from a national security viewpoint to understand that they could do it and they could do it easily and quickly. They could do it by building these weapons and keeping them under roofs where we could not see them.

In addition to that, there are some new devices, things that are part of a more advanced program that we don't fully understand. We did have a threat briefing before, and I remember that I showed you some early indications of some of their developments, ———. I have a gentleman with me from the DIA today. If you would like, I will show you an update where they are with that, and we can show that within the security portion.

PENETRATION AIDS

Mr. DICKS. One thing that's been talked about repeatedly is the need for penetration aids on our ICBMs, on our missiles. But we don't seem to have them at this point. Does this reflect a DOD judgment on the seriousness of Soviet defense capabilities and developments, the fact we don't have penetration?

General ABRAHAMSON. I believe that in this year's request we have requested money to begin to develop penetration aids.

Mr. DICKS. In your professional judgment, is this an area we should be pursuing more vigorously?

General ABRAHAMSON. Yes.

Mr. **Dicks**. Would a robust U.S. effort in this field assist you in determining what an SDI system might have to do in order to overcome potential Soviet penetration aids?

General **Abrahamson**. I think it would be helpful, but I think you must understand we are doing that as part of this program already. If you would like, I can show you some indications of that.

This is what is called a thrusted replica.

[Clerk's note.—Classified slide removed.]

General **Abrahamson**. ———.

Interestingly enough, you have to do more than that. It is a very, very complex issue. If we have good enough radars for these kinds of systems, you have to also make sure that the dynamics are the same. Every one of these things as they come in develop a little coning and they begin to move around in a particular way. Not only do you have to thrust, you have to insure that the coning angles and other measurable aspects of these things are the same. ———.

Here are other designs in-house. You could take a thrusted replica, ———.

Next, please.

[Clerk's note.—Classified slide removed.]

General **Abrahamson**. I think I have shown this, although some of you may not have seen it. Here is where we are taking and we are building an ———.

Now, earlier Mr. AuCoin brought up the question: "Couldn't they just put a heater inside of a balloon decoy?" There is a simpler way to deal with that problem than putting a heater inside. Here is the balloon and this is the ———.

We have gone beyond that. We are building, trying to see if we can build reasonable ———.

We know this. We are working it out. These people out there are saying, "Oh, you can easily defeat and throw this away." With what I consider to be these simplistic kinds of statements, they can throw up a thousand decoys, and some of the Union of Concerned Scientists kind of cringe.

We are doing this. We are doing it responsibly, and we are doing it well. We are not going to bring a recommendation before the administration, whoever it may be, or before a Congress, without understanding not just where they might go technically and where our intelligence says they might go but where indeed we know that they can go scientifically. We are looking for the fundamental areas where defense has an advantage. In that way, one reason this program costs so much is because we have got to fund not only these kinds of things, we have to fund intelligence programs because there are intelligence requirements that the intelligence community can't meet in order to understand these things. ———.

The key that's important about this war decision, this offensive deterrence and defensive deterrence, is a subjective judgment, and it's their decision. It is not our decision. If they are overconfident in their ability to fool us, or if they are overconfident in their ability to get through or to deploy a partial system, but by doing that would be able to effectively negate what might be only a ragged retaliatory strike on our part. They may be wrong, but if they make that judgment wrong, we are all in deep, serious trouble.

That's why we think it is time to look at a more stable kind of situation in the future, why it is worthwhile investing in these kinds of things, and why we are trying to conduct a responsible broad-based research program that indeed considers these things.

I can't go out and argue with some of your critics about the level of information that we have about their systems and all the specifics of this, but I can allow you to know about it. That is important, and I want you to know about it.

POTENTIAL SOVIET BREAKOUT FROM ABM TREATY

Mr. Dicks. Just for the record, is there a concern on your part about the near-term potential for a Soviet breakout of the ABM Treaty? What could they accomplish, in your judgment, in the next five years, without the constraints of that treaty, for the record?

General Abrahamson. All right. I think the problem goes something like this. This is obviously an opinion, and I am sure that there are many opinions that would go along with it. What the Treaty itself recognizes is that the long pole in the tent is the command and control and surveillance system. The Russians have been working on that ever since they signed the treaty. They have been working on radars, improving those radars and in fact are also now using laser systems to begin to understand it as well. They have improved their capability, and all at once that is in place—this partially effective system that they now have around Moscow—they have gotten 20 years of experience ———.

That is the concern, and I think they could do that within five years.

Mr. Dicks. Please answer the following questions for the record.

[Clerk's note.—Questions submitted by Mr. Dicks and the answers thereto follow:]

GOALS OF SDI

Question. General Abrahamson your testimony states, "The goal of the Strategic Defense Initiative is to conduct a vigorous program of research on emerging technologies in search of a better basis for a credible deterrence and strengthen the stability of peace through strategic defense."

Recognizing that deterrence is in the mind of the would be attacker, we still must have some idea about what we believe will provide an effective deterrent. Judging by your comments on the asymmetry between Soviet and U.S. ICBM force structures, you believe that reducing the confidence of the Soviets about the prospects for success from a hard target first strike would enhance deterrence. Is SDI intended to contribute to this effort? Is it an important objective of the program?

Answer. The purpose of the defense options we see is to find a means to destroy ballistic missiles before they can reach any of their potential targets. The SDI program places emphasis on options which provide the basis for eliminating the general threat posed by ballistic missiles. This simply to protect our retaliatory forces from attack. Of course, if a future President elects to move toward a general defense against ballistic missiles the technological options that we will explore will certainly also increase the survivability of our retaliatory forces.

COST EFFECTIVENESS OF SDI CRITERION

Question. When we reach the point of deciding on whether to proceed with development of a strategic defense system, should we consider the cost and effectiveness of alternative means to achieve this same objective?

Answer. The national decision on whether to proceed with full development and deployment of SDI, a decision we expect to support in the early 1900's, will be based upon the criteria of military effectiveness, system survivability and cost-effectiveness. The last criterion means that we will consider in our evaluation of options generated by SDI research the degree to which certain types of defensive systems, by their nature encourage an adversary to try simply to overwhelm them with additional offensive capability, while other systems can discourage such a counter effort. This criterion is couched in terms of cost effectiveness; however, it is much more than an economic concept.

NEAR TERM LIMITED DEPLOYMENT OPTION

Question. Some have suggested that we might initially deploy a more limited system that would be based on more mature technologies in the terminal defense realm to protect our retaliatory forces, while continuing to research whether a more comprehensive system might be feasible, survivable and cost effective. Is this an option that SDIO is actively considering?

Answer. It is possible that SDI technology may have great utility in protecting NATO installations against the emerging threat from Soviet conventionally armed ballistic missiles. If our research demonstrates that effective strategic defenses are feasible, and following appropriate consultation and negotiation, a phased-in approach is quite likely to permit some parts of a system to be deployed within the next decade.

LEAKAGE RATES

Question. Both the President and Secretary Weinberger have stated that an SDI system would not have to be 100 percent effective in order to meet its goal. What degree of leakage would be acceptable in your best current judgment in order to meet the stated goal? An ability to limit penetrating warheads aimed at strategic assets might provide an unfavorable exchange ratio and thus deter this type of attack, but the same leakage rate might not deter an attack against cities or economic targets. Is consideration being given to the impact that SDI may have on Soviet attack strategies?

Answer. It is still too early in the SDI research program to make a definitive judgment about the degree of effectiveness that would be required in order to meet the goals of the SDI. However, the layered defense approach would offer a powerful disincentive to a potential aggressor because of the large uncertainties introduced in planning and launching a successful attack. Given the absence of active and passive U.S. defenses today, an attacker must consider duty his missile reliability, warhead reliability, yield, accuracy and target hardness in seeking to destroy a target. To assure a high probability of success, up to three warheads may be dedicated to a target. If faced with a single layer defense having a 20 percent leakage rate, the number of warheads would need to be increased by only three to five warheads per target to give the same measure of confidence in destroying the target. However, if faced with a three-layered defense, each layer having an eighty percent effectiveness rate, the attacker would have to deploy literally hundreds of warheads to a single target to obtain the same confidence of success. With a strategic defense having four or more layers, with possible engagement at any point along the ballistic missile trajectory, deterrence would be substantially bolstered by this reduction in an attacker's confidence of success. If our objectives of developing reliable defenses are realized, proliferation would be forestalled—given the fact that even prohibitive increases in numbers of Soviet warheads would not change their inability to destroy U.S. targets.

Question. What requirements were included in the guidance of the Phase I Architectural Studies for leakage rates and coverage? If there was no specific direction, what did each of the studies assume?

Answer. ———.

Question. General Abrahamson, you were quoted in the New York Times as saying that "The question is no longer can we do such a thing, but when, how fast and at what cost."

In your official statements, you continue to state that you want to put a future President and Congress in a position to make a decision on development of such a system in the early 1990s.

What is your view of this question?

Answer. Our purpose is to provide a future President and a future Congress the technical knowledge required to support a decision on whether to develop and later deploy advanced defensive systems. Our progress to date demonstrates clearly that if the program is properly funded we will be able to support such a decision in the early 1990's. This progress is evident in conventional and innovative technical research, system concept studies, and an ever increasing awareness that this country and our Allies have the capability and resources to address the challenges associated with the research.

Question. Are you saying that there is no doubt in your mind that not only will the technologies under examination function in an effective manner to defeat offensive nuclear forces, but they will work together as an effective system, that countermeasures and survivability are no problem?

Answer. There is no doubt that we will examine the widest possible set of technical options to provide effective defense of critical assets of the United States and her Allies. In this examination we seek to demonstrate feasibility of key technologies. The results of the research will necessarily address the integrated effectiveness of the system in light of countermeasures and survivability. The degree to which uncertainties in those areas may exist will influence the decision for follow on engineering development.

Question. If that is the case, why are we being asked to spend $10s of billions over the next five years for research on this program, why don't we just move to development today?

Answer. It does not make sense to proceed to development before research is complete and we determine the feasibility of effective strategic defenses. We are not yet capable of picking detailed designs for all the major components of a system providing strategic defense against ballistic missiles. Powerful new technologies are becoming available but their full utility is uncertain. Significant demonstrations can be performed over the next few years that will provide evidence of capabilities required of an effective defense system and the feasibility of technology to build that system. To prematurely enter full development would no doubt result in selection of system design specifications that would not use all the technology of which we are capable and would not be fully efficient and effective.

Question. If you are convinced that the question is already determined then you must know what system architecture would look like, how we will provide transportation and logistic support, and how we will meet all possible countermeasures. Could you please share these answers with the Subcommittee?

Answer. The system architecture is not defined. There are a large set of competing approaches as how to select and assemble system components. Much is unknown about emerging technology and assumptions are necessary to national constructs of the architecture. With research we will be able to eliminate certain approaches and focus on others. By the 1990s we will acquire the technological basis to define both the capabilities required of an effective system and a detailed system architecture.

Question. Isn't it more accurate to state that while some concepts that might be involved in strategic defense have been demonstrated in principle that there are still a number of questions that remain to be answered before we can make an informed judgment on whether as well as how to proceed with development of such a system?

Answer. There are indeed still a number of questions to be answered before making decisions for future system development. The basic concepts of the research plan identified by the Defense Technologies Study (the Fletcher Study) are being pursued with the purpose of supporting knowledgeable decisions in the future concerning engineering development. We expect to provide the basis for informed decisions in the early 1990's on whether or not to develop and later deploy such a defense.

Question. Please describe some of the major accomplishments that SDI has provided to date, how they relate to a potential defensive system, and what further has to be accomplished before such a system could become a reality.

Answer. As the SDI moves into its third year, progress in several SDI programs continues at an impressive rate. Of particular significance are achievements in SDI experiments that demonstrate that a defense against ballistic missiles can become a reality.

In the past year several SDI experiments have netted results which scientists have been able to use to better understand the potential of directed and kinetic energy in a strategic defense system.

One of the most significant demonstrations of the potential of ballistic missile intercept involved in the launching of an ICBM dummy warhead from Vandenberg Air Force Base, California, toward Kwajalein Missile Range, and the endoatmospheric intercept and destruction of the warhead by an optically guided homing overlay. The Homing Overlay Experiment (HOE) is significant for the role it could provide in a layered defense to assure a high level of ballistic missile defense effectiveness in the SDI program.

A second experiment which was a major milestone in the research program was the destruction of a Titan booster by a large chemical laser, MIRACL (Mid-infrared Advanced Chemical Laser) at White Sands Missile Range, New Mexico. In this test a Titan booster was configured to simulate the atmospheric pressures experienced by an ICBM in a flight trajectory and was destroyed. Results of this test have increased scientific understanding of the lethality of lasers against ICBMs—an integral part of a proposed SDI system.

Another set of experiments vital to our understanding of the potential feasibility of an SDI system involved the tracking of a sounding rocket in space. Tests at the Naval Pacific Missile Range in Hawaii demonstrated the ability of a low-power, visible laser to track a rocket, without distortion, through the atmospheric veil. The test was particularly noteworthy because it was the first time a laser beam, adjusted for atmospheric distortions, had been propagated from the ground to space.

In April Secretary Weinberger announced the successful interception of a target hung from a balloon. This is just one experiment in a series of experiments that will be conducted on a well instrumented range to assist our understanding of interception-dynamics.

These and other examples are now beginning to show the directions the technology programs should take to accomplish the purpose of this research.

Question. The research effort in SDI has also uncovered some aspects where the difficulties we face are greater than some had forecast. One of these areas is reportedly in the area of discrimination. According to information I have received from visits and briefings with participants in the program, passive discrimination, for example, has shown to have serious shortfalls that have led to examination of other discrimination alternatives. Please describe what we have learned in this area and any other areas where research has shown that the challenges may exceed those forecast by the Fletcher Commission.

Answer. It is true that we do not feel that passive discrimination techniques alone are adequate to solve the midcourse discrimination problem that SDI faces. This was recognized by the Fletcher Commission and is reflected in their strong recommendation to develop active imaging sensors to aid in discrimination during the Post Boost vehicle deployment phase. We currently believe that a combination of passive, active, and interactive discrimination techniques may be required especially for postulated Soviet responsive threats. There is no single discriminant that can be remotely measured that cannot be countermeasured in principle, but various combinations of discrimination techniques can be chosen that limit the number of credible threatening objects to manageable levels. One of the primary roles of passive sensors in the discrimination problem is to sort our various debris from killed boosters, post boost vehicles, and RVs from the threatening RVs and decoys. The active and interactive sensors can then concentrate on the RVs and intentional decoys that are not discriminable by passive means.

SOVIET DEFENSIVE DEVELOPMENTS

Question. General, your testimony indicates in regard to Soviet defensive efforts that "these active defenses provide the Soviet Union a steadily increasing capability to counter the retaliatory forces of the U.S. and its allies, especially if those forces were degraded by a Soviet first strike, as provided for in Soviet military doctrine."

What are our current intelligence estimates of our ability to deliver weapons on target in a retaliatory response? Specifically, what targets would we be unable to cover as a result of current Soviet defensive capabilities? How will strategic modernization plans effect this?

Answer. ———.

Question. The United States program for penetration aids has in the view of some not been aggressively pursued. Does this reflect a DoD judgment on the seriousness of Soviet defensive capabilities and developments? In your personal and professional judgment, is this an area that we should be pursuing more vigorously? Would a robust U.S. effort in this field assist you in determining what an SDI system might have to do in order to overcome potential Soviet penetration aids?

Answer. The DOD—through the Air Force's Ballistic Missile Office—is, in fact, pursuing an active and broad program in offensive penetration aids. The SDI Countermeasures Office has developed a close working relationship with the BMO Advanced Strategic Missile Systems Program. We believe that this sharing of information between the two activities is extremely important.

Question. Is there a concern on your part about the near term potential for Soviet breakout of the ABM treaty? What could they accomplish, in your judgment, in the next five years without the constraints of the treaty?

Answer. Yes, there is a concern about potential for Soviet ABM Treaty breakout. ———.

TIME SENSITIVITY OF SDI

Question. Questions have been raised about the hard and fast requirement for a development decision in the early 1990s. Your testimony responds with another question—can we afford to wait? You then go on to suggest that it is not clear that there will be enough political support to maintain deterrence based solely upon offensive forces. If in fact it was clear that such political support existed would it make sense to consider deferring the development decision?

Answer. The goal of an early 1990s decision is essential for a number of reasons. Any well-managed, focused research program must have temporal as well as substantive goals. Otherwise, there would be a real danger of endlessly-prolonged research. Thus, President Kennedy's call for the United States to go to the moon by the end of the 1960s was vital to the success of the Apollo program. In addition, if we stretched out the decision point, the quality of research probably would suffer through lost momentum and difficulty in retaining key personnel, while overall costs would increase through changes to carefully-developed research plans. Above all, the combination of the Soviet Union's continued buildup of offensive forces, and its extensive, longstanding programs in strategic defense, make resolute action imperative. If left unchecked and unanswered, those Soviet programs would undermine the basis on which deterrence has long rested.

For the foreseeable future, offensive nuclear forces and the threat of nuclear retaliation will remain the key element of deterrence. Therefore, we must maintain modern, flexible, and credible strategic nuclear forces. The SDI, modernization of our strategic nuclear forces in the near-term, and the pursuit of radical reductions in offensive nuclear forces, are all necessary and complementary responses to the Soviet trends of the last decades. To reduce our commitment to one of those efforts would undermine the effectiveness of the others. We must simultaneously use a number of tools to achieve our goals today while looking for better ways to achieve our goals over the longer term. Successful SDI research and development would not lead to an abandonment of deterrence but rather to an enhancement of deterrence and an evolution in the weapons of deterrence through the contribution of defensive systems that threaten no one.

Question. What specifically do you mean when you talk about a decision to proceed with development? Would this be full scale development of a specific system?

Answer. The purpose of the SDI program is comprehensive and intensive research into emerging technologies with the aim of finding better ways of deterring aggression, strengthening stability, and increasing security of the United States and its allies. Our objective is to provide to a future President and a future Congress the technical knowledge required to support a decision whether to proceed with full scale development of a specific system for deployment.

Question. When in the early 1990's would you evision such a decision will be made? Is it closer to 1991 or 1994, or do we have some flexibility?

Answer. The research progress to date provides confidence in a development and deployment decision by the early 1990's. It is too early to predict any one particular year as the decision point. Delays in progress could be caused by reduced funding or even unavoidable circumstances such as further difficulties with the space shuttle program. Unforeseen events, including technology breakthroughs, can either accelerate or retard the research pace. It is essential that we pursue the program as expeditiously as possible to enable us to make an early decision on whether to proceed to development. The threat we face from the development and deployment of new Soviet offensive and defensive forces continues to increase. We cannot expect the threat to decrease if we slow our SDI effort.

Question. This time frame was a target originally suggested by the Fletcher Panel. But there is some concern that it has taken on more of a political significance. You acknowledged that Congressional decisions to hold your budget increase to only three times its level of two years ago has increased program risk. Time is a limiting factor as well. Are we increasing program risk by holding to an arbitrary date for a development decision?

Answer. We have submitted budgets to Congress to support the broadly based research effort suggested by the Fletcher panel. As a multi-faceted program, it is critical that all elements of the SDI be orchestrated in a coordinated, phased approach. The requisite research on relevant technologies must be vigorously pursued to provide the President and the Congress with the foundation necessary for an informed decision with respect to moving ahead with development of defenses against ballistic missiles. At this stage, the most serious threat to the pace and ultimate success of the SDI program continues to be congressionally-imposed funding limitations. We have been forced to accept increasing program risk due to budget shortfalls.

Question. If that date were deferred are there some technologies that you might explore that have been downgraded instead? Is there some risk that we may lock ourselves into technologies that may have lesser long term prospects in order to pursue technologies with more short term payoff in order to meet this date?

Answer. The United States is pursuing the broadly based SDI research program in an objective manner. We have no preconceived notions about the outcome of the research program. We have identified key criteria including survivability, cost-effectiveness and military effectiveness, that will be applied to the results of this research whenever they become available. Some options which could provide interim capabilities may be available earlier than others, and prudent planning demands that we maintain options against a range of contingencies. However, the primary thrust of the SDI research program is not to focus on generating options for the earliest development/deployment decision but options which best meet our identified criteria.

SDI COSTS

Question. There is considerable debate over the ultimate costs of an SDI program. Based on the Phase I Architectural Studies, what are your best estimates of what the system proposed in each of these studies would cost?

Answer. Much more research and analytical effort will be required before it will be possible to establish a good estimate of the cost of various defense system architectures. Much will depend on such characteristics of the numerous elements of the system as overall size and weight, on the future cost of launching defense elements into orbit, and on the overall size of the Soviet threat that the defensive system must counter. However, even at this relatively early stage of the research program, it is clear that the extremely high cost estimates volunteered by SDI critics ($1–1.5 trillion) are well off the mark.

Question. General, you have spoken in terms of what a system "should" cost. Is this to say that if we cannot meet this goal, then the Nitze criteria of cost-effectiveness would not be met?

Answer. As I have said, we intend to consider, in our evaluation of options generated by SDI research, the degree to which certain types of defense system, by there nature, encourage an adversary to try simple to overwhelm them with additional offensive capability while other systems can discourage such a counter effort. We seek defensive options which provide clear disincentives to attempts to counter them with additional offensive forces. Although this is phrased in terms of cost-effectiveness, it is much more than an economic concept.

Question. The fiscal year 1986 Authorization Act requires you to provide an estimate of deployment costs for SDI as soon as possible, and no later than submission of the Fiscal Year 1989 budget request. Do you feel confident that you will be able to fulfill this directive?

Answer. Yes, but I would note that the SDIO is trying to provide the technology to support the broadest practical menu of ballistic missile defense options for the early 1990s decision. There will be no single SDIO architecture in FY 1989 but a number of optional architectures. Further, I would caution that such estimates of deployment costs will not be based on the hard data obtained in full-scale development since none of the concepts will have reached that stage by FY 1989.

Question. What is the estimated funding level for SDI for each of the years in the five year spending plan? Do we have any estimates of funding requests beyond that point?

Answer. The SDIO research and advanced development estimate remains unchanged at twenty-six billion dollars.

Appropriated and requested funding levels by year are as follows:

Fiscal year 1985—Appropriated	$1397.3
Fiscal year 1986—Appropriated	2759.2
Fiscal year 1987—Requested	4812.9
Fiscal year 1988—Planned	5511.5

Studies and analysis results to date are insufficient to provide reliable order of magnitude estimates for full scale engineering development or deployment estimates.

We are confident that initial gross estimates of SDI deployment cost estimates will be provided in accordance with the Fiscal Year 1986 authorization act not later than submission of the Fiscal Year 1989 budget request.

NUCLEAR DIRECTED ENERGY WEAPONS

Question. The FY 87 request includes $603 million for SDI related programs in the Department of Energy. What is included in that request? Specifically how much is for the X-ray laser?

Answer. Included in the $603 million requested for FY 1987 for SDI-related programs in the Department of Energy is research pursued under both the Assistant Secretary for Defense Programs (ASDP) and the Assistant Secretary for Nuclear Energy (ASNE).

The major Department on Energy (DOE) Defense Program (DP)-funded SDI responsibility is research to determine the feasibility of Nuclear-Driven Directed Energy Weapons (NDEW) concepts and thereby understand and assess adversary directed energy weapon threats of offensive nuclear weapon systems and potential defensive architectures. These concepts include the X-ray laser, hypervelocity pellets (HVP), microwaves, optical lasers, and particle beams. A related and highly important DP responsibility is NDEW lethality, vulnerability, and countermeasures research. This activity consists of both computer modeling and experiments. System studies are also done to evaluate and provide assistance and recommendations to the Strategic Defense Initiative Organizations (SDIO) on the technical and operational aspects of DOE SDI technologies.

The major DOE Nuclear Energy (NE) program responsibility is research in space power systems that would supply prime power for a number of SDI weapons and other systems. These applications include multimegawatt power for non-NDEW weapons; space-based radar systems; communications, command, control, and intelligence (C^3I); cryogenic cooling of nonreactor power sources; tracking systems; and sensing systems. The NE activities supporting nuclear space power include the SP-100 program, the multimegawatt program, and dynamic isotopic power sources programs extending from a few kilowatts to hundred of megawatts. The budgets for the activities by Assistant Secretary are provided below.

STRATEGIC DEFENSE INITIATIVE (SDI) CROSSCUT

[Dollars in millions]

	Fiscal Year—		
	1985	1986	1987
Assistant Secretary for Defense Programs			
Atomic Energy Defense Appropriation:			
Weapons Activities:			
Research and Development	$85.8	$110.1	$234.0
Testing	129.2	157.8	231.0
Capital Equipment	0	0	56.0
Construction: Strategic Defense Facility		2.0	15.0
Total Atomic Energy Defense Weapons Activities	215.0	269.9	[1] 536.0

[1] Approximately $136 million of Laboratory operating expenses budgeted in Fy 1987 are to be spent on X-ray laser research.

CONGRESSIONAL OVERSIGHT

Question. I certainly recognize the importance of flexibility in a research program such as SDI. At the same time, when the Congress is being asked to appropriate a sum for this activity that exceeds all other technology base programs we have a responsibility to provide some oversight.

One way for us to get a better picture of what is involved in the SDI program is through the annual report to Congress required under the Authorization Act. The Congress has yet to receive this report this year even though it was due on March 15. When can we expect such a report to be delivered? Will an unclassified version accompany the classified annex of the report at the same time?

Answer. Both a classified and unclassified annual report have been prepared and distributed to the Congress.

[CLERK'S NOTE.—The classified version of this report was received by the Committee on March 6, 1986; the unclassified version was received on June 26, 1986.]

Question. The Congress has given SDIO flexibility in implementing reductions which Congress has voted in your funding levels. You have also added substantial sums to programs beyond what was discussed in Congressional testimony and reports without any prior notification or approval. Under what authority do you take such actions as going from zero to $73 million on NPB discrimination and ——— on X-ray laser?

Answer. We have taken actions to exploit what we see as exciting technologies in essentially a technology base program. These activities are not systems development in the 6.4 Engineering Development sense. If they were we would certainly seek Congressional approval of new starts or major accelerations. Rather the activities are 6.1 Research, 6.2 Exploratory Development, and 6.3 Advanced Development activities in basic technology areas such as directed energy weapons. SDIO has the responsibility to ensure that the resources allocated by the Congress exploit, to the fullest extent possible within those resources, promising new technology developments that offer a better chance of achieving the SDI objectives.

Question. Would it be reasonable to advise the Congress of any plans you may have in the course of a fiscal year to make such a large increase in programs given the level of interest in the issue?

Answer. The nature of a research effort such as the Strategic Defense Initiative (SDI) is such that the plans to assess various elements of technology must remain dynamic to a certain extent. Flexibility must be available to terminate certain experiments and open or expand others based on emerging results. Because of this, DoD management authority for redistribution of appropriated funds within each of the six program elements for SDI is appropriate. Significant changes from the approved budget in the use of those funds will be detailed for the Congress in the annual SDI Report to Congress.

IMPACT OF CONGRESSIONAL CUTS

Question. Secretary Weinberger has been quoted as saying that "SDI is making much greater 'progress than he anticipated.' The barriers we saw to progress are crumbling."

How does this reflect on the impact of Congressional reductions in your budget request, which you have claimed are crippling?

Answer. Congressional reductions to our budget request have necessitated early decisions and choices regarding program design and execution. We have been forced to accept higher program risks, prematurely down-select certain promising technologies and in general pursue a more austere research program. This approach has not allowed us to assess alternative or fall-back technology at an adequate level to minimize program risk. On the other hand, we have made substantial progress. Advances in gallium arsenide production, research on infrared sensors and designs of survivability technologies have produced promising results. It is essential that we pursue the program in a manner that will enable us to make an early 1990's decision on whether to proceed to development. Our budget request for FY87 of $4.8 billion attempts to move closer to the levels recommended by the Fletcher study in 1983. It is imperative that we adhere to the funding levels if we are to reach our goal.

Question. You have stated that the impact of Congressional reductions has been to prematurely downselect technologies thus increasing program risk.

Was this the only factor in down selections, or did research indicate that in fact some technologies did not show much promise and thus should not receive considerable investments in funding and scientific talent?

Answer. With very minor exceptions, no down selection of technologies has occurred because research indicated that the technology in question did not show promise. After the budget cuts by Congress, the Strategic Defense Initiative Organization reallocated the available funds in a manner that attempted to minimize the negative effect of the reduction on the overall goals and objectives of the program.

Question. Were such factors involved in the down selection of chemical lasers and passive discrimination systems?

Answer. No. Slowing the pace of chemical lasers and passive discrimination systems was a result of the large budget reductions imposed by Congress. These budget reductions have had the effect of not allowing the SDI to adequately fund alternative or fallback technologies that are necessary to minimize program risk. The best example of this in the Directed Energy Program where the technology is not mature and the number of potentially promising concepts large—only a few technologies can be emphasized.

SDI AND ARMS CONTROL

Question. One issue that we continue to face is the continued adherence to existing arms control agreements.

The President has recently decided to dismantle two Poseidon submarines which will keep the United States below the 1200 limit on MIRVed ballistic missile systems. The Soviets have also dismantled offensive systems that has kept them within this ceiling. If both sides were to continue to observe such limitations, would this make it more likely that an effective Strategic Defense system could be developed and deployed?

Answer. We are structuring our research progress to counter an "unrestrained" Soviet threat. By this we mean that we are exploring technologies that would be able to defeat the worst that the Soviet could build. I am optimistic that research will lead to technologies which would be effective even against these worst case threats. I am also convinced that, as the Soviets see the effectiveness of strategic defenses they will choose not to increase offensive forces and will enter into negotiated offensive reductions with the United States. This will of course make the requirements for a developed defense far more modest. Yet reduction in order for an effective strategic defense to be feasible.

Question. What additional challenges would be placed on SDI should the Soviet offensive force structure increase by two or three fold?

Answer. The baseline Soviet threat has been assumed to be larger than it is today. Increases in numbers of Soviet warheads by a factor of two or three in the next two decades are consistent with our threat estimates. The baseline strategic defense concepts we are examining are sized to handle this increased threat.

Question. What benefits would result if we were to achieve a 50% reduction in offensive forces as both sides have agreed to in principle at last November's summit?

Answer. Reduction in offensive forces will of course make our defensive problems easier. I believe such decreases are desirable whether or not we ever deploy defense. However, I am also convinced that the prospects of effective defense makes these 50% reductions, and even deeper reductions more likely. Moreover, effective defenses might one day underwrite the integrity of agreements controlling offensive arms by diminishing the incentives to break out or violate such treaties.

Question. Is it fair to say that the more constrained the offensive force on both sides, the more confidence we could have in the ability of strategic defense on both sides to enhance stability?

Answer. Stability criteria depend on a number of factors. Effective defenses which meet our survivability and cost effectiveness criteria will enhance stability greatly. The levels of offensive forces existing or defenses to be deployed cannot be determined at this time. Thus, it is difficult to know how many offensive weapons would be needed for stability as we transition to a defense-reliant deterrent relationship with the Soviet Union.

SDI AND THE ABM TREATY

Question. The President has repeatedly stated that the SDI program would be conducted in conformance with the ABM Treaty. Your testimony reiterates this commitment. However, there is some debate over the precise impact of ABM Treaty restrictions on advanced technologies. While the President has pledged to observe the so-called "restrictive" interpretation, which has been U.S. policy since ratification, he has also acknowledged that there is justification to hold a view that the only limitations on advanced technologies occur at deployment.

In your 1985 Report to the Congress, you commented that all planned activities in SDI would be in conformance with the ABM treaty. At that time the only interpretation being discussed was a "restrictive" interpretation. Has there been any change in your program that would now violate the "restrictive" interpretation in your judgment?

Answer. No.

Question. According to recent reports in the press you have now been directed to examine what you might do if you if were allowed to use the interpretation that only deployment was restricted. What is the status of such a study and when might it be completed?

Answer. It is not clear what reports in the press you are referring to or their content. However, under the terms of the ABM Treaty, both parties are allowed a limited ABM deployment (See Article III of the Treaty). Deployments of ABM systems and their components as defined in the ABM Treaty, beyond the Article III limits (as modified by the 1976 Protocol) are restricted by the Treaty. The SDI program is a research and technology development effort focused on establishing technical feasibility to permit a decision in the early 1990's on whether to proceed to system-level development. The program is being conducted within the limitations on the ABM Treaty. The President has directed that for the time being, the SDI program will be conducted within the narrow interpretation of the ABM Treaty. This is periodically to be reviewed in order to fully understand the implications of this restriction.

Question. Based on what you know today, what demonstrations would you consider including in the SDI program that are not in compliance with the ABM Treaty as integrated up to this point? When would such demonstrations take place?

Answer. All experiments currently planned by the SDIO are consistent with the more restrictive interpretations of the ABM Treaty. Our objective is to provide a future Congress and President the knowledge necessary for an informed decision on whether or not to proceed toward a more stable future strategic environment based on increased emphasis on defenses. As we proceed with our currently planned research, we will be able to determine future experiments which would be most fruitful.

Question. Would such demonstrations be critical in order to allow a development decision? Are there alternative approaches to examining the same technological issues?

Answer. "Such demonstrations" referred to are not yet identified. We will continue to plan all SDI research experiments, and demonstrations to provide this country's future decision makers the highest level of confidence possible within budgetary, technical and treaty limitations.

Question. The ABM Treaty is up for its five year review next year. Is the proper interpretation of Treaty restrictions on advanced technologies an issue that should be discussed in this review process?

Answer. Article XIV paragraph 2 of the ABM Treaty provides an opportunity for the parties to "together conduct a review of this Treaty." At that time both parties presumably have a wide range of potential topics they can propose to the other that are appropriate for review. Certainly, portions of the Treaty may be clarified or even changed, by mutual agreement of the parties. However, the applicability of Article V, paragraph 1., to ABM systems and components based on other physical principles (the so-called debate between the restrictive vs. the legally correct interpretation of the ABM Treaty you refer to in your question), is a settled issue, properly determined by a thorough review of the negotiating record of the Treaty.

Question. What would be the impact on Soviet efforts if they used the less restrictive interpretation?

Answer. The legally correct interpretation to which you refer reflects what the United States and Soviet Union agreed in 1972. The Soviets have always interpreted the Treaty in this manner. Because the Soviets are very secretive about their long-standing defensive research, development and deployment programs, it is difficult to establish the details of all Soviet defensive efforts so as to assess the extent to which they might be exploiting the limits of the legally correct interpretation. Nevertheless, it is clear that the Soviet Union has violated the ABM Treaty—whatever the interpretation.

TRANSITION PHASE

Question. You have mentioned in the past a possible transition period as strategic defenses come on line. Ambassador Nitze has discussed such a period in his explanations of how strategic defenses would be put into place.

1. Describe your understanding as to how such a transition might take place.

2. Might we initially deploy a system that would provide point defense for strategic assets, and then later move on to a more comprehensive system?

3. Is SDI presently structured on an assumption that we initially deploy a system for point defense of strategic assets? If we were to decide that we wanted to move as quickly as possible to a system that would enhance deterrence by increasing the survivability of our strategic assets, but that overall funding would not increase, what changes would be needed in the program?

4. Deployment of any comprehensive system would take some time, especially if it involved any substantial numbers of space-based components. What special problems would be present in such a transition phase, especially in the area of survivability? Would we require some agreement with the Soviets not to interfere with such systems while deployment was ongoing or would we consider any attack on such systems as a hostile act that warranted retaliation?

Answer. 1. It is our intention and our hope that, if new defensive technologies prove feasible, we (in close and continuing consultation with our allies) and the Soviets will jointly manage a transition to a more defense-reliant balance. What we envision is a jointly managed approach designed to maintain, at all times, control over the mix of offensive and defensive systems of both sides and thereby increase the confidence of all nations in the effectiveness and stability of the evolving strategic balance.

It is inappropriate to try to describe now the details of a possible transition because those details would depend to a great extent on the specific characteristics of strategic defenses being deployed by both the United States and the Soviet Union. For our part, we do not have any preconceived notions about the defense options our research may generate. With regard to the Soviets, we are seeking in the Defense and Space Talks to discuss with them the offense/defense relationship. A primary objective of that discussion is to facilitate the joint management of a possible transition in a stable fashion.

2. I do not believe it would be appropriate to use point defense by itself as the initial deployment of a strategic defense system. Two factors support my conclusion.

First, in his address to the nation of March 23, 1983, the President described his vision of a world free of its overwhelming dependence on nuclear weapons, a world free once and for all of the threat of nuclear war. The SDI is a broad-based research program investigating many technologies that may help bring about the President's vision. We see real merit in the potential of advanced technologies providing for a layered defense, with the possibility of negating ballistic missiles at various points after launch. Such a layered defense would both enhance confidence in the overall system and compound the problems of a potential aggressor in trying to defeat such a defense. Initial deployment of a point defense system would likely not use such a layered system concept and thus would not provide the benefits of such a system.

Second, in our evaluation of options generated by SDI research, we will consider the degree to which certain types of defensive systems, by their nature, encourage an adversary to overwhelm them with additional offensive capability while other systems can discourage such a counter effort. We seek defensive options—as with other military systems—that are able to maintain capability more easily than countermeasures could be taken to try to defeat them. We know from experience that a point defense system can offer incentives for increases in offensive weapons to overwhelm such a system; this is not what we want.

3. The SDI program is a research and technology development program and is not structured to support early applications of defensive weapons deployments. Any effort to redirect the SDI towards a development and deployment program could have a substantial and negative impact on our ability to develop the technologies and architectural concepts necessary to support an informed decision in the early 1990s on whether to develop and deploy defenses against ballistic missiles.

4. It is too early in our research program to speculate on the kinds of defensive systems—whether ground-based or space-based and with what capabilities—that might prove feasible and desirable to develop and deploy. Nevertheless, we will not proceed with development and deployment unless the research indicates that defenses meet strict criteria.

One of these criterion is survivability. If a defensive system were not adequately survivable, an adversary could very well have an incentive in a crisis to strike first at vulnerable elements of the defense. Application of this criterion will ensure that such a vulnerable system would not be deployed and, consequently, that the Soviets would have no incentive or prospect of overwhelming it.

ARCHITECTURAL STUDIES

Question. Please summarize the results of the Phase I Architectural Studies.

Answer. The Strategic Defense Initiative Organization (SDIO) completed Phase I of an SDI Systems Architecture and Key Tradeoff Study in the Fall of 1985 and is currently completing Plase II.

Comprehensive briefings on the results of Phase I and Phase II to date are available from the SDIO. The key result of Phase I and Phase II to date, and of other architecture study activities conducted by SDIO has been the identification of several classes of SDI system architectures. These include:

(1) Architectures with space-based and ground-based components;
(2) Architectures that emphasize ground-based components; and
(3) Architectures that address the peculiar problems of the Allied or theater defense.

Some special purpose architectures have also been considered such as architectures suited to circumstances in which offensive weapons are limited by arms control treaty restrictions.

Question. What issues did they identify as areas of particular concern?

Answer. Good exoatmospheric discrimination, especially against large numbers of light decoys, is essential for effective midcourse defenses. ———.

The development of next generation launch vehicles to put the substantial numbers of assets into space.

Reducing the production costs for space platforms, weapons and sensors to make an affordable multi-layer defense.

The need to manage a strategic battle and maintain command, control and communications in a system of many elements and many kinds of elements, distributed widely in space and attempting in a hostile environment to engage a responsive threat that is numerous and complex.

Question. What is the range of suggested systems in the studies? Is there some range as to how much of an SDI system would be spaced based? Is there a range of the relative roles played by boost-phase, mid-course and terminal defense?

Answer. The most robust architecture class combines both space and ground-based components. The space-based assets are configured to provide effective defense during the boost, post-boost, and midcourse phases of the threat trajectory. They also provide self-defense and protection against various Soviet responsive defense suppression threats. The ground-based components are used to engage the threat during the late midcourse part of the threat trajectory and within the atmosphere at both high and low altitudes. The large number of opportunities to engage the threat with this architecture leads to an expectation of achieving very low levels of defense leakage even if the Soviets were to proliferate their offensive forces.

A second architecture class, which used predominately ground-based assets, combines forward-based defensive components with defensive assets located near the target being protected. Like the first architecture class, a ground-based architecture can provide several opportunities to engage the threat and can thus achieve low levels of leakage of attacking missiles through the defense.

A third architecture class, configured to defend against tactical ballistic missile (TBM) threat, particularly the short range and low apogee of some of these threats. This architecture class, which could operate as a stand-alone system, consists predominantly of ground-based components capable of multiple sequential engagements of the threat in the terminal endo-atmospheric region.

The space-based components include sensors like the Space Sensor System (SSS). This is used for various space surveillance functions including detection and track of the booster, post-boost vehicles and micourse objects, as well as for detecting and tracking kinetic anti-satellite (ASAT) threats. These sensors also perform the discrimination function. In the initial stage of a defense system, the space-based weapons probably would be kinetic kill vehicles in a highly distributed configuration. Later, directed energy devices (DEW) may be added to provide advanced interactive discrimination. Particle beam systems and/or laser devices of various types are being considered for this function. Still later, when advanced directed energy technology would be available, space/based or ground-based system of sufficient brightness and agility (retarget time) may be incorporated to enhance the boost phase kill capability for the defense, if such enhancement is warranted.

Question. What criteria is being used to transition from these study results to Phase II studies? What is being dropped as a result of these studies?

Answer. Phase I of the SDI System Architecture and Key Tradeoff Study was conducted by ten industrial contractor teams, competitively selected. At the conclusion of Phase I, five of these teams were selected on the basis of performance in Phase I to conduct Phase II which examined SDI architecture issues in the same breadth but with more time and resources to permit a greater depth of study. The results of these efforts have been systematically conveyed to the technology activities within the SDI program. The consequences has not been so much a deletion or addition of the program elements as the identification of utilities or needs which may offset program emphasis.

EASTPORT STUDY

Question. The Eastport Study Group submitted a report in December to examine the issue of an appropriate computational/communications response to the SDI battle management problem. Their conclusion was that the complexity of this task made it the paramount strategic defense problem, and called for an increased emphasis on early development of software. They argued that to develop hardware first, and then expect battle management to take care of itself was putting the cart before the horse.

What specific changes are being implemented in the SDI program as a result of this study?

Will you reexamine the results of the Phase I Architecture studies in light of the Eastport recommendations?

Answer. The SDIO has recently received the report of the Eastport Study Group, the panel from industry, government and academia that was appointed "to devise an appropriate computational/communications response to the (strategic defense battle management) problem and make recommendations for a research and technology development program to implement the response."

The essence of the report is captured by the following quote from it:

> The panel concludes that computing resources and battle management software for strategic defense systems are within the capabilities of the hardware and soft-

ware technologies that should be developed within the next several years. However, the anticipated complexity of battle management software and necessity to test, simulate, modify, and evolve the system make battle management and command, control and communication (BM/C3) the paramount strategic defense problem.

To address this issue the report offers a research strategy that emphasizes the interaction of BM/C3 with system architecture. In this vein, the panel assesses that:

> Software technology is developing against inflexible limits in the complexity and reliability that can be achieved. The tradeoffs necessary to make the software task tractable are in the system architecture. As indicated in the Fletcher Report, the "applique approach" of designing the system and then writing the software to control is the wrong approach for the SDI. System Architecture and Battle Management must be developed together.

With this perspective, a number of specific observations and recommendations are made relative to technology research in computing software, processing hardware, and in communications. The innovations and potential payoff of the recommended approaches are recognized. Where appropriate the SDIO will augment its BM/C3 technology research to incorporate the recommended steps, even as the SDI seeks innovation from all quarters and from all technologies.

The SDIO endorses the spirit and content of the report of the Eastport Study Group. It is found to be in harmony with the needs of the SDI program and its rapid implementation shall be pursued throughout the R&D effort.

SURVIVABILITY AND COUNTERMEASURES

Question. Survivability is one of the critical Nitze criteria for any successful Strategic Defense program.

What is the SDI program doing to examine potential threats to the survivability of an SDI system? How are these threats evaluated and countermeasures developed?

Answer. The SDI is employing a coordinated threat-development countermeasures program which has been described in some detail in this year's report to Congress (Appendix A). Survivability assessments and analyses in FY 1986 and beyond include ———.

Question. Are the various labs and others involved in this program using a uniform threat analysis for examining their activities? If not, why not? If so, how was this uniform threat analysis developed? Is the threat analysis updated on a periodic basis?

Answer. There are three documents which describe our current understanding of the Threat. These are: the SDI Baseline Threat; the Responsive Offensive Threat; and Defense Suppression Threat. All contractors working on SDI programs are required to use these documents. The documents were produced by SDIO using the Army and Air Force as agents. The documents were reviewed by the Intelligence Community and published by the Foreign Technology Division. They will be updated on a yearly basis as more work is added.

Question. A wide range of possible threats and countermeasures have been surmised. For the record please briefly describe how you might respond to each of the following:

SAMPLE OF SOVIET THREATS AND COUNTERMEASURES SDI MIGHT FACE

Anti-satellite weapons
Electronic countermeasures
Space mines
Para-military forces
Depressed trajectories
Booster hardening, spinning
Quick PBV release
Salvage fusing
Decoys
Masked warheads
Ground based lasers
X-ray lasers
Pellets in orbit
Proliferation
Clustering ICBM launches
Fast-burn boosters
Maneuvering
Penetration aids
Anti-simulation
Saturation attack

Answer. Responses to Countermeasures: ———.

TRANSPORTATION AND LOGISTICS

Question. With the problem we face with the shuttle and the explosions of Titan missiles, attention has focused on the problems of transporting military hardware into space. General, you have testified in the past that we will have to make order of magnitude improvements in costs to deliver hardware into space if SDI is to be affordable.

With the shuttle, what is the current cost to lift a pound of material into orbit?

Answer. The authoritative answer to your question should come from the NASA and I am sure they can quickly provide an official figure. A cost of $1500–3000 per pound is used frequently but these numbers must be subject to many caveats. The exact answer depends on whether or not you include such things as development and production costs and certain fixed facility costs. The marginal cost for one additional flight is clearly less if development and production costs are amortized.

Question. Phase I architecture studies indicate that anywhere from 20 to 200 million pounds would have to be put in space. With today's systems that would mean 600 to 5,000 shuttle launches and cost between $30 billion and $600 billion. In your view what will we have to reduce the price to lift a pound of material to in order to make SDI achievable?

Answer. It is impossible at this point to relate the cost per pound to low-earth orbit to whether or not SDI is achievable simply because the answer is too closely linked to whatever system architecture is chosen. For example, if we were to select an architecture that made only minimum use of space-based assets, then the cost per pound to orbit could be relatively high and not significantly impact total systems costs. We have, however, established a goal of reducing transportation costs by a factor of ten or more in anticipation of extensive use of space-based systems in most candidate architectures. Our ability to achieve this objective at a reasonable investment cost will be just one more factor as we evaluate various candidate systems architectures.

Question. Will this require a major shift in the way we deploy systems into space?

Answer. The SDIO is on record indicating that a new family of more cost efficient space transportation systems will likely be necessary. The manpower intense nature of Shuttle and ELV operations must evolve toward those associated with airline and truck-ing systems, i.e., standardized interfaces, large design and operations margins, quick turn-around and automated checkout. More cost efficient access to space is possible using these techniques if the national investment is made now to provide these capabilities in the post-1995 timeframe.

Question. One alternative being discussed is the hypersonic plane. Is this in fact a leading candidate, and if so when might it be available?

Answer. The National Aerospace Plane (NASP) program is a commitment to reinvigorate the U.S. capabilities in hypersonic research. We are working, literally, on the edge of technology. If the research over the next few years on aerodynamics, structures and propulsion moves along successfully, the DoD and NASA are proposing to build an *experimental* flight vehicle in the early to mid 1990s. Only after we've flown this experimental vehicle can we begin to talk about full-scale development of a hypersonic aircraft with *possible* space-lift capability. While the potential clearly exists for using NASP technology for a heavy-lift access-to-space system, it is far from being self evident that it is the most optimum approach. The application of NASP-type structural materials to rocket-powered single-stage-to-orbit vehicles may result in systems more cost efficient and operationally flexible than NASP. With regard to schedule, if a new, more cost efficient national capability for heavy-lift access to space is needed before 2000–2005, a very optimistic, success-oriented NASP program must be assumed. Accordingly, NASP is not our only and certainly is not our leading candidate for the next-generation of space-transportation systems.

AIRBORNE OPTICAL SYSTEM

Question. The SDI office has restructured the AOA program as a result of cost growth by eliminating one of the two sensors that was to be tested in this program.

What did we give up as a result of eliminating the Aerojet sensor?

Answer. By eliminating the Aeroject Sensor, we gave up one of the two sensors in the AOA Program, which provided redundancy in case of the failure of one of the sensors. The ability to perform real time sensor-to-sensor correlation and the direct comparison under the same conditions, of two different design approaches to meeting the same requirements have been given up. However, no sensor technical capability for performing the AOA Experiment was given up by eliminating the Aerojet sensor.

Question. How did the two candidate sensors compare in terms of sensitivity, acquisition range, and resistance to nuclear effects.

Answer. ———.

Question. Is this a case where, in order to keep on an arbitrary test schedule, we chose to abandon a more promising technology for long term application?

Answer. No, it is not. The AOA test schedule is not arbitrary. It is set by the role of the AOA in the overall SDI program. The AOA experiment schedule is critical to provide early validation of key functions as a basis for an SDI decision. Although the Aerojet technology is more suitable for a long term tactical AOS, it is not critical for the AOA experiment, itself.

Question. As a passive discrimination program, what benefits would this experiment provide, if we, in fact, have to take a different approach through interactive discrimination.

Answer. Although the AOS experiment uses a passive infrared sensor, the primary discrimination (high endoatmospheric) approach depends on the natural interactions of ballistic objects (RVs, buses and decoys) with the atmosphere as they reenter to produce heating, drag or slowdown, and perturbed vehicle dynamic motion. The interactive discrimination approaches are primarily techniques for exoatmospheric discrimination. ———. The results of the AOA experiment would provide a basis for comparison of the effectiveness of different methods. ———. In addition, the process of interactive discrimination requires viewing and tracking of the objects as they react to the external environment. Passive infrared sensor technology is a leading candidate for this application. AOA technology developments will provide key data for this application of passive infrared sensors.

[Clerk's note.—End of questions submitted by Mr. Dicks.]

Mr. Chappell. Mr. Hefner.

Mr. Hefner. No, I just had a couple of questions concerning military construction, but I think we covered them the other day.

General. Abrahamson. Yes, sir.

Mr. Chappell. Mr. AuCoin.

ALLIED PARTICIPATION IN SDI

Mr. AuCoin. General Abrahamson, as we were talking here, I was mindful of Prime Minister Nakasone's recent visit and the statement he made. What success have we had to date in interesting our allies in participating in the SDI? Can you just briefly answer that?

General Abrahamson. Yes, sir. The offer was made some time ago. I personally have been disappointed in how long it has taken to bring some of the allies that were expressed earlier to the point where they are now beginning to really actively be involved. We have signed an agreement with the British. That agreement provides security confidence for their companies so that they can go ahead and facilitate really contracting. We have signed an agreement with the Germans. Although the German government has not indicated they are ready for the same level of involvement as the British government, German industries are ready to participate in the SDI program. We have completed a negotiation with the Israelis and the MOU should be signed within just a few days.

By the way, the Israelis have already developed their very short-range architecture against even such missiles as Scuds. They have some unique ideas and they haven't waited in many ways.

There have been discussions with the Italians and they are going through parliamentary process where we expect that they will sign up with us. Meanwhile, several of the other countries have said they will not sign an agreement of any particular kind but they will allow their industry to participate under existing security arrangements in the normal NATO method of operation. Those countries are, for example, Netherlands, Norway, Belgium. Even France falls in that category.

The Japanese have sent a major delegation, 55 people. That is the largest delegation that we have had from any of the countries.

Mr. AuCoin. From any country?

General Abrahamson. Yes, sir. They have gone around and we have allowed them to see what basically it is that we are doing so they have better understanding of it, and I believe they are now going back digesting that and will go whatever decision they think is appropriate.

Mr. AuCoin. Do you have any idea what the percentage of the Fiscal Year 1987 budget this would be?

General Abrahamson. No, sir.

Mr. AuCoin. Used by our allies or foreign firms?

General Abrahamson. No, sir, because we are just using a ground rule they must be competitive. This is not the kind of effort where we guarantee them any amount of money or do anything that way. We are really looking for very good ideas where they can contribute.

Mr. AuCoin. What percentage of this year's dollars?

General Abrahamson. So far, it's very, very small. It's really only several millions of dollars. I am sure that it will grow as we go through the rest of the year, and next year it may well become more important, but it depends on the quality of their inputs and how they fare in several of these competitions.

ARMS CONTROL AND SDI

Mr. AuCoin. One other question. What about the relationship between the SDI and offensive arms control? If the Soviet offense could be limited both quantitatively and qualitatively, could that make your job significantly easier?

General Abrahamson. Of course it would. But I think the key point that we have to keep in mind, and obviously that has to be kept in mind with or without an SDI, is what the character of that limit is. Do we really know; can we verify it exactly and very carefully, and do we know if it is a permanent kind of thing and something they can't surprise us over a short period of time?

So, in our planning for SDI, we of course hope for the very best and we do our best to support negotiations with the Russians for providing an atmosphere that will allow those negotiations to proceed effectively to cut down the systems. We also do our planning in such a way so that we know that we can't let the Russians be able to veto a development that is in the security interests of the United States, veto implicitly by not agreeing to some minimum number or something that we had planned to defend against.

ALLIED PARTICIPATION IN SDI

Mr. AuCoin. General, going back to that allied participation, can you hazard a rough guess as to what the percentage of foreign participation might be in the coming fiscal year?

General Abrahamson. Sir, I really can't because it's competitive.

Mr. AuCoin. Do you have any idea what Mrs. Thatcher meant when she said that the British must get their fair share?

General ABRAHAMSON. The questions you are asking are very appropriate. Obviously officials, newspapermen, and parliamentarians from each country, always ask: "What does this mean, what does it mean in terms of dollars, what does it mean in terms of contracts or technology?" The answer that I have to give everyone is that in the short term we are interested in small teams that can make major contributions; therefore, participation does not mean that unemployment problems in an aerospace industry or something of that kind will not be solved. In the long term, should our research be successful, and should a program go forward, hopefully all of our allies would join us in funding such an effort. I think it could have a great deal of significance. But it is, of course, much too early to predict what that might mean at this point.

Mr. AUCOIN. I have several questions for you to answer for the record.

[CLERK'S NOTE.—Questions submitted by Mr. AuCoin and the answers thereto follow:]

SPACE MINES

Question. In response to my question about space mines, you suggested four countermeasures: tether, run out of fuel, jam, and shoot back.

How long a tether do you envision?

Answer. The exact length of the tether would be determined by the nuclear hardness level of the defensive satellite. The mine would follow the orbit of the center of mass of the tether or would have to continually expend maneuver fuel to stay in the same orbit as the intended target satellite.

Question. How confident are you that a tether of sufficient length and rigidity can be deployed within probable weight constraints? Please provide quantitative specifics.

How successful has our experience with tethers been?

What is the longest tether we have used successfully?

Answer. There is a joint NASA/Italy tether project with a projected 1989 launch date to tether a scientific payload from the space shuttle ———. These figures are for scientific payloads which are not optimized for long term operational missions. There are other alternatives for tethers such as carbon fibers with much higher tensile strength ratings and resistance to the effects of nuclear detonations. These hold the promise for even longer tether lengths at lower weights.

Question. Since both tethering and maneuvering can be performed by the space mine as well as by the satellite, the questions seems to be which can devote the larger weight fraction to tethers or fuel. Since the SDI satellite must track multiple targets and attack at long range, vs. the space mine which need only track a single target and attack at short range, it would seem that the SDI satellite needs to carry more primary mission payload than the space mine. Therefore, it would seem the space mine would have more weight to devote to tether and/or fuel per pound of total weight. If you disagree, please explain why.

It would seem the space mine could counter jamming for the SDI satellite by using a highly directional receiver and antenna systems pointing down and receiving from the Earth, or pointing away from the SDI device and receiving from another satellite. If you believe this would not work, please explain why?

Answer. The supposed simplicity and low cost of the space mine is what makes it such an attractive threat to critics of strategic defenses. When the space mine is forced to add extensive maneuver capability, a tether system of its own, on-board terminal guidance, anti-jam communications, and other operational requirements, the simplicity and cost arguments simply disappears, because now the space mine becomes as expensive and complicated as the satellite it intends to destroy. The mine also becomes more readily indentified with increased equipment.

Question. Shoot-back is obviously of limited utility if the space mine shoots first. Do you therefore, envision shooting at the space mine from a state of peace? In the absence of ASAT-control agreements, what evidence exists that the Soviets would accept destruction of their space mine, rather than responding with further escalation?

Answer. When a space mine maneuvers toward a high value target, many political and operational indicators can be used to determine hostile intent. After the intended target maneuvers away, if the space mine continues to close and the mine is declared hostile, one of the systems used to intercept ICBM's could be used to destroy the space mine before it closed with lethal range of its target.

[CLERK'S NOTE.— End of questions submitted by Mr. AuCoin.]

Mr. CHAPPELL. Mr. McDade has several questions he would like you to answer for the record.

SDI FUNDING

[CLERK'S NOTE.—Questions submitted by Mr. McDade and the answers thereto follow:]

Question. General, last year, in response to a question for the record, you stated that in FY 86 SDI would require $2.5 billion simply to continue the research program which was started in FY 85, with an appropriation of $1.4 billion.

In FY 86, the SDI program received an appropriation of $2.75 billion. What amount of funding is needed in FY 87, merely to pursue the program of research set in motion by the FY 85 and FY 86 appropriations (and not fund natural spin-off requirements as well as new initiatives)?

Answer. Approximately $4.1 billion is required in FY 1987 simply to continue with the programmed research begun in previous years, without initiating promising new areas of research.

CHANGES IN SDI PROGRAM FROM LAST YEAR

Question. General, it has been a year since we last had you here and I would expect that some of the details of your SDI effort have changed since then. This could be for two reasons: first, we provided a billion dollars less than you had requested last year, so I expect you had some difficult changes to make to the program.

However, it seems to me that the program may also have changed in some ways because you have gotten another year of research under your belt. With that additional time, perhaps you have discovered that some ideas are more promising than you had believed a year ago; conversely, some ideas may be less attractive.

Can you tell me, in broad brush terms, how your program has changed since last year? And can you distinguish between those decisions which were driven by the cut in your request, and decisions taken because of new information?

Answer. Our early research program contained options that were not fully explored because of budget limitations. For example, space-based chemical laser research was reduced prematurely. Further, reduction in short wavelength excimer laser, directed energy weapon atmosphere compensation and optics, and other alternative or fall back technologies were either eliminated or reduced in scope because of budget reductions. These program changes have increased the risk to program success by early forced decisions on possible system technology. Additionally, we have had to delay the pace of certain experiments which may ultimately cause delay in program completion. However, we believe the program goal, to support an informed decision in the early 1990's, is still achievable. This is due to progress in certain areas that has reduced somewhat the damage of previous budget reductions. Progress has been noteworthy in interactive discrimination, optical surveillance sensors, free electron lasers and kinetic energy weapons, among other areas. These results have led to greater emphasis on ground-based free electron detection lasers, and space-based neutral particle beam, kinetic energy, and space pointing and tracing experiments.

TIMEFRAME FOR SDI DEPLOYMENT

Question. General, the purpose of SDI is to provide enough information for a possible decision in the early 1990's to deploy strategic defenses. A "decision" to deploy, correct? I stress "decision," because I believe there is a misconception among many that SDI could result in deployment the day afterwards. There may have to be a lengthy development period, testing, etc. Can you elaborate on this? Let's assume you get all the money you want for the next five years, and a decision is made to deploy in the early 1990's. Can you give us a ball-park estimate as to when actual deployment would be feasible? Perhaps you can distinguish between the more mature technology—the ground-based interceptors—and the more exotic types, directed energy, space-based weapons.

Answer. Your understanding is absolutely correct. The SDI program is a research program to explore key technologies associated with concepts for a comprehensive defense against ballistic missiles. The level of effort is geared to permit a decision in the early 1990's on whether to proceed with confidence to system-level development. From the time of a decision to develop and deploy defenses, it would take several years for full deployment. A transition phase could be a period of incremental, sequential deployment, with each added increment further enhancing deterrence. It is likely that more mature technologies may be part of an initial increment; those technologies include ground-based interceptor missiles to destroy attacking reentry vehicles in their mid-course and terminal phase. Recall, the Homing Overlay Experiment conducted in June, 1984, proved the capability of a nonnuclear ground-based interceptor to destroy an incoming ballistic missile outside the earth's atmosphere. However, the deployment of any defense, especially a comprehensive defense, with layering to assure a successful defense, containing all the necessary sensors, defensive weapons and command and control components would be several years after a decision to enter into system development.

SDI AND MIDGETMAN

Question. General, I know that Midgetman is not your program but I would like to ask a few questions about the relationship between Midgetman and the SDI.

Midgetman and SDI have several things in common. In different ways, they represent efforts to reduce our vulnerability to the Soviet nuclear force. Hopefully, they both would represent a way to strengthen deterrence, and make the nuclear balance more stable. Finally, they both will be very expensive.

These shared characteristics unfortunately could bring the Midgetman and SDI in competition with each other—especially in a fiscally-constrained environment.

What is your opinion? Are SDI and Midgetman incompatible with each other? Are you working with the Air Force to develop ways to include Midgetman in a future scenario that includes strategic defenses? At present it seems that the Midgetman, if deployed, would be on mobile launchers based over a large geographic area. It seems to me that if we are looking at ways to provide an active defense of Midgetman—terminal defense—it would be very difficult to provide a terminal defense because of the large area involved, and the very mobility of the missile. Does Midgetman make your job tougher or easier?

Answer. We are looking ahead to the day when we can fulfill the President's vision and make a transition from deterrence based primarily on offense to one founded increasingly on defense. For the foreseeable future, however, we must continue to rely on offensive forces to maintain deterrence. A small ICBM (SICBM), properly designed and optimally deployed, could contribute significantly to maintaining the effective deterrence we will need. Moreover, the general defense against ballistic missiles which is the goal of the SDI would also increase the survivability of our retaliatory forces—including the SICBM.

The Office of the Secretary of Defense is working with the Air Force on the effect defenses would have on the survivability of various basing modes for the SICBM. This work is being conducted in support of the SICBM Joint Requirements Review Board (JRMB)–II scheduled for December of this year. This study is considering each basing mode, developing defense concepts that would compliment it, and then evaluating each in terms of the amount of additional survivability and technical risk for comparison with its non-defended counterpart. The study group will then develop plans, costs and schedules for those concepts that appear promising. Finally, the results will be made an integral part of the JRMB decision process later this year.

SDI AND ALLIED INVOLVEMENT

Question. General, one of the goals of the SDI is to explore ways to defend our allies, as well as our country. And already, several of the allies have publicly committed to joining with us in developing defensive technologies.

(1) What is the current status of Allied participation in SDI?

(2) Are Allied Governments planning to spend any money in connection with this effort?

(3) Will U.S. SDI funds be awarded to off-shore contractors?

Answer. (1) We have entered into government-to-government agreements (Memoranda of Understanding) concerning SDI research participation with these countries: Israel, the Federal Republic of Germany, and the United Kingdom. We may sign similar agreements with other allies. Some other allies invited to participate in SDI research have decided not to conclude such an agreement, but to take the actions necessary to permit their private sectors to seek and perform SDI contracts. We continue to have general government-to-government discussions on SDI research with a number of our allies.

(2) Allied participation in SDI research may take a variety of forms, including direct contracts from the SDIO, sub-contracts, and jointly-funded cooperative research projects.

(3) SDI contracts have been awarded to allied firms, and we anticipate that more will be in the future. All such awards are on the basis of technical merit, and consistent with U.S. law, regulations, and national policy.

SDI AND ANTI-TACTICAL BALLISIC MISSILES

Question. One of the biggest threats to NATO is that of theater and tactical ballistic missiles, such as the SS-20, and the shorter-ranged SS-21, -22, and -23. The Allies seem very interested in countering this by developing an Anti-Tactical Ballistic Missile, or ATBM, system. This development would seem to dovetail with the SDI goal of providing missile defense to our allies.

Is development of an ATBM part of SDI? If so, how much money is programmed for this?

Answer. The SDI is examining technologies and concepts for defense against ballistic missiles of all ranges. We except that many SDI technologies and concepts can contribute significantly to a NATO ATBM effort. Since that is not a separate ATBM program within the SDI, and individual research programs may be relevant for various aspects of the ballistic missile defense problem, we cannot say specifically how much money is programmed for ATBM.

Question. The Soviet surface-to-air missile, the SA-X-12, has been alleged to have some capability against tactical ballistic missiles like the Pershing. The Administration also claims it could be used in an ABM role against some strategic missiles, such as SLBMs. The Administration has claimed that this could constitute a violation of the ABM Treaty.

If the Soviet ATBM—the SA-X-12—is a treaty violation, wouldn't NATO development of one be a violation as well?

Answer. The ABM Treaty does not limit defenses against non-strategic ballistic missiles—ATBM systems—provide that such defenses do not have ABM capability. To implement this, the ABM Treaty sets forth two separate prohibitions on surface-to-air missile (SAM) systems: not to give such systems capabilities to counter strategic ballistic missiles and not to test such systems in an ABM mode.

The United States adheres strictly to these and all other provisions of the ABM Treaty. We are concerned, however, that Soviet SAM systems may violate the Treaty—concern that is heightened by other Soviet ABM activities, including the construction of the large phased-array radar near Krasnoyarsk in clear violation of the Treaty. Together Soviet ABM and ABM-related activities suggest that the USSR may be preparing an ABM defense of its national territory.

The possibility that the SA-X-12 violates the ABM Treaty does not mean that a NATO ATBM system would do so.

NATIONAL TEST BED

Question. I have read that SDI will soon award a major contract "for something called the "National Test Bed."

(1) What is the National Test Bed?

(2) What is the dollar amount of this award?

Answer. (1) The National Test Bed will include a number of geographically distributed developmental, experimental and simulation facilities which will be electronically linked. Key among these will be the National Test Facility which is to provide a comprehensive computer simulation research capability to demonstrate and evaluate alternative strategic defense technologies.

(2) At this time we have not yet completed site selection for the National Test Bed. Cost estimates for the National Test Bed and Facility are dependent on not only which site is selected but also which contractor is chosen among the firms now competing for facility design. Cost estimates will be formulated when those decisions have been made.

CREATION OF SDI "GOVERNMENT THINK TANK"

Question. General, earlier this year there was some discussion that you wanted to create a "think tank" for SDI—like the Federally Financed Research Centers (FFRC's) already in existence, such as the RAND Corporation. The purpose of such a group would be to conduct many of the analysis needed for evaluation of SDI options.

(1) Can you shed some light on this notion? Do you want such an organization? Why?

(2) Can you give us some idea as to how much this would cost?

(3) This group would supposedly conduct feasibility studies, which could be the basis for future decisions on whether to actually deploy defensive systems. Yet this organization is strictly a creature of the SDI effort. It would work for you, get its money from you, exist only because of SDI. How could you get unbiased evaluations about SDI feasibility from an organization whose fate is directly tied to the program?

Answer. (1) We plan to create an organization which we will call the Strategic Defense Initiative Institute (SDII). It will have two basic functions: (a) overall systems architecture work at the macrolevel involving integration of research from an overall cost-efficiency and trade-off perspective, and (b) evaluation and coordination of research performed by private industry and other outside entities. We arrived at the choice of SDII organized as a Federally Funded Research and Development Center after an extensive review of in-house and external support resources. The SDII can best perform the required functions.

(2) We have not yet evaluated any proposals and cannot forecast a cost estimate at this time. We could anticipate a staffing of about 150 technical professionals and a requisite number of support personnel.

(3) We anticipate the initial contract to cover operation of SDII for five years. SDII will be part of the SDI program, with the role of providing technical support in evaluation and integration of research. SDII will be independent in the sense of having its own management and will be charged to provide objective support in the form of advice, recommendations and evaluations. We anticipate many distinguished science and technology professionals to be part of SDII and will expect SDII to provide objective and unbiased evaluations of SDI research.

[CLERK'S NOTE.—End of questions submitted by Mr. McDade.]

SURVIVABILITY

Mr. CHAPPELL. General, I know that your percentage change in fiscal 1987 is 43 percent for the survivability and lethality area, which indicates that you have significant planned increase in the very subject Mr. Dicks was talking about.

General ABRAHAMSON. Yes.

NUCLEAR DIRECTED ENERGY WEAPONS

X-RAY LASER

Mr. CHAPPELL. Let me come back where I started, with some additional questions on X-ray lasers. This would use a nuclear explosion as a source of power for the laser. Is that correct?

General ABRAHAMSON. Yes, sir.

Mr. CHAPPELL. And you are planning significant acceleration in the development of this technology beginning in fiscal year 1986. Why don't you tell us what you are doing with it, where we are, what kind of potential it has and how it fits into the transfer, so we can be sure we understand it.

General ABRAHAMSON. This is a concept of an X-ray laser system. Remember that could be American or could be Russian, either one. It uses a bomb, not a large bomb, perhaps around ———. When the bomb goes off, there is ——— that comes out and interacts with ———. The resultant hits lasing material. ———.

It turns out ———. When the ——— it causes a huge X-ray burst, in a true, coherent fashion, meaning that it is a laser but it is in the X-ray frequency. So you can send out a one-time, very strong burst of X-ray laser energy in the direction you desire. It can be propagated in a very direct manner to the targets in space where it doesn't hurt anybody. Now, the first concept—this is one—where you aim several of these things, and of course as the bomb goes off it destroys it. This all has to happen in about ———.

By the way, that report, since that is one in favor of us, I would surely like to see published at the appropriate classification level. The X-ray laser is not the only nuclear concept, it is not the only one that the Russians might use.

Mr. **Chappell**. Is the X-ray affected by gravitational pull of any kind?

General **Abrahamson**. No. But it cannot penetrate deeply in the atmosphere. How deeply is one of the unknowns.

Mr. **AuCoin**. Therefore, it is a defensive weapon?

General **Abrahamson**. Yes, it is clearly a defensive weapon.

Mr. **AuCoin**. What gives you reason to believe that the Russians might be moving in that direction?

General **Abrahamson**. Well, if I recall, the concept of the X-ray laser was something that first appeared in the Russian literature in 1974. We also have—

[Discussion off the record.]

General **Abrahamson**. ———. You can't accelerate instantaneously. You must build up and have people working on getting ready for those tests. We felt it was significant enough to warrant making some additional hard choices in our budget and propose to Congress we conduct a transfer of funds to DOE.

Now, these aren't the only concepts here. Let me go to another one.

Mr. **Chappell**. You are trying to find out what its range is, its capability is in the atmosphere?

General **Abrahamson**. Yes, sir.

Mr. **Chappell**. Do you have any indication so far what it will do in space?

General **Abrahamson**. We can make theoretical calculations about that. That is not so difficult. What you have to be able to do is measure how much that beam really stays together and ——— and then we can do that calculation. By the way, part of the controversy ———.

Mr. **Chappell**. How fast did you say?

General **Abrahamson**. ———.

I should compute that ——— for you. Maybe somebody could do that on the side.

Mr. **Dicks**. This is one that is a nuclear explosion?

General **Abrahamson**. Yes, sir.

Mr. **Dicks**. This is X-ray?

General **Abrahamson**. No, this is not X-ray. While you were out of the room I went through where we are in the X-ray laser.

Sir, here is another one. This is called ———. This is one done primarily at Los Alamos. Here is another interesting concept, and it is one that we are looking at for several purposes here. This is the concept called ———.

[**Clerk's note**.—Classified discussion removed.]

I felt that even though we had to make a very difficult choice, with our own DOD funding, that we should indeed make the step, the transition so that they can begin to hire people and begin to do the design on some of these systems so that we can increase our understanding of these concepts and the threat they might represent to us.

Now, these are not the only things, and I think it is valuable if you just gave perhaps not a entire briefing, but some of the updates.

Mr. CHAPPELL. Let's go into special access session at this time.

[CLERK'S NOTE.—The committee proceeded into a special access session. The transcript of that portion will not be printed. It has been retained in the committee's files.]

Mr. CHAPPELL. General Abrahamson, thank you for your testimony. We have some additional committee questions for you to answer for the record.

[CLERK'S NOTE.—Questions submitted for the record and the answers thereto follow:]

BUDGET REDUCTION IMPACT

Question. Why has work on sensors and kinetic energy weapons been so greatly cut from last year's plan?

Answer. The SDI FY 1986 budget request was reduced by 26% by the Congress. That reduction required prudent management to ensure program goals were achieved in the best manner possible, given the budget limitations, and resulted in major program changes. Among those were changes to the sensor and KEW programs. The strategy used to apply the reductions was to accept increased program risk by eliminating or reducing scope of research in alternative technologies, and delaying other research as necessary. This strategy resulted in the cutbacks noted in Sensors and KEW, but have not yet caused the overall schedule to be slipped. Where possible, the kinetic energy program has been configured to emphasize technology programs which are relevant to are than one application area in order to minimize overall costs. For example, lightweight component experiments are applicable to the eventual SBKKV system as well as to the eventual ERIS system.

FUNDING FOR MAJOR EXPERIMENTS

Question. The amount of funding for major experiments in FY 1987 is $2.5 billion, which is the amount recommended by this committee for all of SDI in FY 1986.

Why is such an increase in demonstrations necessary?

Answer. Proof-of-feasibility experiments are intended to show the feasibility of key technologies. Emphasis is on the early resolution of major issues, which if resolved favorably, can have a substantial impact on the success of ballistic missile defenses over the long run. Demonstration of capabilities experiments involve technology that has been demonstrated as feasible and must be integrated with other subsystems to show that desired performance levels can be achieved. These experiments are oriented toward resolving the key issues needed for possible developments decisions in the early 1990's.

Question. This represents 53 percent of the SDI budget for FY 1987. How does that compare to FY 1985 and FY 1986?

Answer. Major experiments were 25% of the FY 1984, 45% of the FY 1985 and 45% of the FY 1986 budget.

SDI BUDGET STRUCTURE

Question. In FY 1986, SDIO adjusted the funding profile significantly for many of its key programs. For example, laser research was reduced from $195 million to $113 million, whereas x-ray laser was increased from $10 million to $105 million. What role did Congress have in approving this major program structure?

Answer. The SDI FY 1986 budget request was $3,722,184,000. The appropriation conferees agreed to provide $2,750,000,000 for the Strategic Defense Initiative (SDI). The conferees also agreed to provide, separate from these amounts, $9,222,000 for SDI Headquarters Management. The 26 percent budget reduction required prudent management to insure the obligation and resulting expenditure rates within the technical areas described in Congressional budget justification materials. Congressional budget reductions have had an adverse impact on SDI research and forced major program changes. We have been forced to reduce the effort on certain major technologies, such as space based lasers, prematurely. Within Directed Energy Weapons, the Nuclear Directed Energy Weapons effort in the restructure increased from $10 million to $105 million. Nuclear Directed Energy Weapons efforts have been accelerated for early resolution of critical nonnuclear SDI system and survivability issues. In addition, Congress was requested to approve a $62 million transfer of FY 86 funds which are within the $105M NDEW effort, from DOD to DOE to support NDEW efforts properly designated as DOE effort. The actual DOD amount expected to be spent on X-ray laser, assuming the $62 million transfer to DOE is $57 million in FY 1986. The DOE portion of X-Ray Laser is expected to be $83 million in FY 1986. Annual Report to the Congress on the Strategic Defense Initiative detailing the SDI program has been provided.

Question. Has this not resulted in the expenditure of FY 1986 funds in a vastly different way than was presented last year?

Answer. FY 1986 funds have been obligated and will be expended consistent with technical context described in Congressional testimony, reports and FY 1986 budget justification materials. The budget reductions have reduced alternative technology research below the level required to minimize program risk. Demonstration of capability programs have been reduced in pace. A number of experiments have been up selected for early proof of feasibility. This will significantly increase program risk and could cause program slippage, therby delaying completion and increasing total costs.

NUMBER OF CANDIDATE TECHNOLOGIES

Question. Last year, you stated that SDI involved research in approximately 80 candidate technologies. What are corresponding numbers for FY 1987 and FY 1988? Has the scope of the research been narrowed?

Answer. In FY86 the SDI program contained about 57 projects and tasks. These activities involved a large number of technology areas subject to interpretation of what constitutes a candidate technology for BMD. It is the objective of the SDI Organization to continue to focus and balance projects and tasks where technically prudent, towards achieving a base of technology from which a ballistic missile defense could be developed.

Narrowing of the research program has occurred due to budget cuts which introduce more risk in validating these technologies than before.

[CLERK'S NOTE.— The SDIO was asked to provide a more responsive answer to this question, but this answer has not been received in time to be printed in this hearing volume.]

MANAGEMENT OF SDIO

Question. The Wall Street Journal reported last August that headquarters management of SDI "has been plagued by contracting delays, understaffing and rivalries between the armed services." Representatives of field organizations conducting a major portion of SDI's FY 1986 program have confirmed that SDIO has experienced severe "growing pains" which are continuing. In addition, SDIO recently moved its offices into the Pentagon to alleviate space and logistics problems.

Would you comment on the severity of these problems and what actions SDIO is taking to address them?

Answer. The SDIO has part of its staff located within the Pentagon and part in it's downtown location. Obviously being separated creates some problems, however we are not experiencing any severe space or logistics problems

Question. Physical relocation usually slows down the work of an office. Do you believe this will occur with SDIO, and how will that impact the FY 1986 program?

Answer. The physical relocation has not slowed down the work of any of the elements involved. We don't believe that there will be any adverse impact on the FY 1986 program.

Question. If SDIO is seriously understaffed, what confidence do you have that the FY 1987 budget was adequately reviewed by your office before submission to the Congress?

Answer. I have full confidence that our Resource Management personnel accurately reviewed the FY 1987 budget prior to submission to Congress.

Question. Has a full-time Deputy Director for SDIO assumed office? If not, why not, and when will this occur?

Answer, Yes, the SDIO Deputy Director is Dr. Gordon Smith.

Question. More than one of every four staff at SDIO fills a clerical or administrative position. Why is such a high percentage of support staff needed? What is the ratio of support to professional staff planned for FY 1987?

Answer. Performing overview and control of the management of a multi-technical program such as the Strategic Defense Initiative Program, requires voluminous justification documentation and scrutiny at all levels by OSD and the Congress. In addition, procedures and technical direction originate at the professional support staff level. This requires establishing policy, setting requirements, issuing directives, implementing procedures and reviewing the progress and results of all aspects of the program. Interface with many other technical organizations, field centers, industry, and scientific and research organizations is required to accomplish the management of the program. An inappropriate number of administrative personnel would significantly impede the objectives of the technical staff which would ultimately result in cost inefficiency and mismanagement of personnel. 21.2% of the SDIO staff serve in a support position. The ratio of support staff is not due to change appreciably in FY87.

Question. Provide the number of new FTE staff planned for SDIO in FY 1987, by office and professional/clerical/administrative.

	Civilians	Military	Total
FY86	107	94	201
FY87	20	5	25
Total	127	99	226

	Professional	Clerical	Administrative
Strategic Concepts	1		
Support Services	1		
Innovative Sciences	1	1	
External Affairs	2	1	
Surv, Leth & Key Tech	2	1	
Systems	5	1	1
Kinetic Energy	2		
Sensors	2		
Directed Energy	3	1	
Total	19	5	1

STAFF RESOURCES

Question. Last year, SDIO stated that the Air Force has a shortfall in the manpower needed to properly execute its SDI programs. The Air Force Systems Command will receive approximately $950 million from SDIO in FY 1986.

General, how many additional staff-years does the Air Force require in FY 1986 to conduct this work, and when will they be provided?

Answer. The current staff-years required for the Air Force in direct civilian hires to support SDIO for FY 1986 is 435. This is an increase of 81 staff-years over FY 1985 requirements. As of this date, all FY 1986 have been provided to the Air Force.

Question. Given that many of the procurement "horror stories" of the past few years have resulted from inadequate quantity or quality of contracting officers, don't you view these shortfalls as a serious threat to maintaining SDI's credibility before both the Congress and the American public?

Answer. A Strategic Defense Initiative related program existed in the Army and the Air Force prior to SDIO being established. This program is not new to the Army or the Air Force Contracting personnel and therefore does not have the same negative impact as if would if the program was completely new. Although many new personnel are being hired, some with limited contracting background, the quality of the product has not suffered. To adjust to the contract learning curves, the time it takes to process a procurement request and make an award has increased, but only slightly. All regulatory requirements are enforced.

Question. SDI is alleviating this problem in part by using "temporary help." Does this refer to the use of contractors for the conduct of program management functions? If so, please explain.

Answer. To adequately perform SDI program management functions military manpower requirements are accommodated by realignment of positions within the Military Services. The future requirements are being identified by SDI POM submission.

Question. Provide a listing of the number of staff provided by each of the services to manage SDI programs for FY 1986 through FY 1988, by year.

Answer. Service manpower spaces are as follows:

	Army	Navy	Air Force	Total
FY86:				
Military	150	0	195	345
Civilian	684	0	240	924
Total	834	0	435	1,269
FY87:				
Military	154	0	194	348
Civilian	906	0	538	1,444
Total	1,060	0	732	1,792
FY88	162	0	225	387
	940	12	632	1,584
Total	1,102	12	857	1,971

Note: FY 85 and FY 86 spaces were included in total Navy civilian direct hire totals.

[CLERK'S NOTE.—The SDI0 has asked to explain why two different estimates for Air Force civilian staff-years in FY 1986 have been provided. The response has not been received in time to be printed in this hearing volume.]

SDI USE OF RDT&E FUNDS FOR CONSTRUCTION AND O&M

Question. The GAO has issued a draft report which raises serious questions about the planning and management control of SDI construction projects. Let's discuss these issues for a moment.

According to the GAO audit, SDIO plans call for 10 construction projects valued at $60 million. Nine of the projects would utilize military construction (MILCON) appropriations. However, GAO field auditors found another 12 projects valued at $21 million which are begun or planned by field organizations using SDIO funds, mainly from the much larger RDT&E account.

Why was SDIO not aware of this significant difference between their plans and actions being taken by SDI field units?

Answer. The SDIO was aware of and had approved planned projects supporting the SDI program. During the formative years of SDIO, the usual turbulence associated with any major new program was encountered. However, SDIO was not afforded the long lead-time normally associated with other established Military Services and Defense Agencies. Initial efforts focused on program structure, identification of resource requirements and the reallocation of those resources relative to program goals. In some instances major adjustments in Services and Agencies technology activities transferred to the SDIO were required. As changes occurred, it became necessary to realign the near term construction program commensurate with test and evaluation requirements and construction affordability. In some instances, projects were not identified to SDIO because of ongoing program adjustments and the potential for Service funding. As noted by the GAO, timely submission of project data forms for inclusion in the fiscal year 1985 budget submission was not possible, as SDIO was not organized until April 1984, four months after the President's submission of the budget to the Congress. However, no construction project was started until Congressional notification requirements were met.

Question. Were design or construction funds obligated for these projects without SDIO approval?

Answer. RDT&E funds were not used to design Military Construction (MILCON) projects as noted in the GAO report. RDT&E funds were only used for planning and criteria preparation prior to design, as they normally are. When projects changed from RDT&E funding to MILCON, the funds for design were also changed consistent with those determinations. Construction projects required to support the SDI program are funded from the correct fund source and have been approved by SDIO.

Question. What action is SDIO taking to address this issue?

Answer. Construction program reviews have been recently conducted by executing agencies and the SDIO to verify that the appropriate funding sources were identified or used for project planning design and/or construction. Reviews are also conducted as part of the project approval process. Written guidance has been provided to the executing agencies concerning the SDIO construction process.

Question. GAO also discovered several instances where RDT&E funds were used for construction efforts when MILCON funds should have been used. Would you respond to this claim?

Answer. SDIO financing of real property projects is consistent with DoD Policy and Public Law 97-214. They are programmed, budgeted, and funded as follows:

1. Government-Owned, Government-Operated (GOGO) Facility on Government Land:

When GOGO property is to be constructed on government-owned land, such construction is normally financed as a military construction project. Construction of facilities for $200,000 or less may be funded with RDT&E appropriations. Such expenditures are authorized under 10 USC 2805 (minor construction). All minor construction must result in a complete and usable facility. In no event are two or more construction projects or minor and major construction projects to be contrived to be a useable facility. Construction projects at R&D installations/activities which are greater than $200,000 are financed by the Military Construction appropriation subject to the provisions of DoD Directives 7040.2 and 7150.5.

2. Government-Owned, Contractor-Operated (GOCO) Facility:

a. When the GOCO facility is on a military installation (post, camp or station) the primary funding is the Military Construction appropriation. However, under unusual circumstances and if for the convenience of the Government, the facilities are contractor operated and the contractor is solely responsible for the complete and total operation and maintenance of the facility complex, construction may be financed under Procurement or RDT&E funds under the criteria of 10 USC 2353 and DoD Directive 4275.5. Construction or improvements having general utility are not permitted under 10 USC 2353.

b. When GOCO facilities are constructed on government property, other than a military installation, the procurement or RDT&E appropriation may finance the construction under the criteria of DoD Directive 4275.5.

3. Contractor-Owned, Contractor-Operated (COCO) Facility: Construction of COCO facilities are financed under Procurement or RDT&E funds under the criteria of DoD Directive 4275.5 and 10 USC 2353.

[CLERK'S NOTE.—The SDIO was asked to respond specifically to findings in the GAO report. This response has not been received in time to be printed in this hearing volume.]

Question. Two instances were found where construction projects began before SDIO notified the Authorization and Appropriations Committees, in apparent violation of Public Law 97-214.

Is this accurate?

Answer. This reported finding is incorrect. Public Law 97-214 does require the Secretary of Defense to submit a report or notification to the Committees covering construction projects not previously authorized, however, a report was not required in the cited cases. This determination is in compliance with Public Law 97-214 and DoD Directive 4270.24 which provides for construction projects whose cost is less than $200,000. Since the construction portion of the two projects mentioned by the GAO for which Congressional notification was not accomplished amounted to less than $200,000 each, a report was not required. (Public Law authorizes the Department of Defense to implement construction below the $200,000 level as lump-sum efforts and without specific project notification). For example, one project cited by the GAO was to modify an existing facility at a cost of $125,000 to house a computer room, and the second was to convert a warehouse into office space in which the construction portion was $138,500. DoD Directive 4270.24 further states that only projects over $200,000 must be documented via the detailed Military Construction Data Form (DD Form 1319) to explain the specific construction project details.

The GAO also identified two other projects *planned* for FY 1985 and FY 1986 where Congress had not been notified. Based on the provisions of Section 2807 of 10 USC, notification is not required prior to initiation of project planning. Section 2807 states that notification is required prior to award of Architect-Engineering contracts for project design in excess of $300,000. As noted by the GAO, construction had not begun on the projects in question.

Question. If so, how will SDIO ensure that this practice does not continue?

Answer. As previously stated, the SDIO has provided requisite congressional notification via out-of-cycle notification or in the SDIO budget documentation. Appropriate guidance has been provided to the executing agencies.

Question. GAO questioned several cases where SDIO funds were being used for operational support. These included an annual payment to the U.S. Fish and Wildlife Service for "maintenance and protection" of the Safeguard missile site, and the planned procurement of a high speed, 200 passenger ferry to transport SDI personnel between Kwajalein Island and Meck Island.

Does SDIO have adequate review and control over the use of RDT&E funds for operational support purposes?

Answer. The Strategic Defense Initiative Organization (SDIO) does have control over the use of Research, Development, Test and Evaluation (RDT&E) funds for operational support requirements. The use of SDIO funds by the executing agencies for this purpose is consistent with the general use of RDT&E funds as stated in applicable DoD Policy. Predating SDIO, funding required for ballistic missile defense research and development was planned, programmed and executed by the applicable Military Department or Defense Agency. However, with the initiation of SDI, funding allocated to ballistic missile defense research and development were subsumed into the SDIO. Subsequently, operation and mainentance responsibilities funded by the RDT&E appropriation were also incurred. The provisions of DoD 711-1M, which is consistent with public law, authorizes the use of RDT&E funds for operational support requirements. Thus, operation and maintenance along with overhead costs associated with R&D projects in the SDI program have been correctly charged to the R&D account. Additionally, the SDIO has no planned use of RDT&E funds for the acquisition of transportation assets. If the acquisition of specific equipment is required to support the SDI program at the Kwajalein Missile Range, it may be funded under the provisions of DoD Directive 3200.11.

Question. How does SDI research benefit from providing maintenance services for an ABM site which closed nine years ago?

Answer. The Army's Safeguard Missile Complex in North Dakota, by treaty, is the only authorized ABM site for the United States. In June 1976, the Safeguard Complex was declared excess government property to the General Services Administration (GSA). From June 1976 to April 1983, annual operation, maintenance and protection cost, totalling approximately $100,000, was paid to the U.S. Fish and Wildlife Service by the Department of Interior. In April 1983, the site was again declared excess and Interior's payment responsibility terminated. Because of its location and potential as a treaty compliant ABM site, funding for maintenance and protection was included in Army funding for ballistic missile defense research. In FY 1985, along with its first funding appropriation, maintenance and protection payment responsibility was transferred to the Strategic Defense Initiative Program. Retaining this site, given the long lead land acquisition process, will allow deployment options to remain open. Furthermore, the site is treaty compliant.

SDI FEDERAL CONTRACT RESEARCH CENTER

Question. SDIO has recently announced the establishment of a new Federal Contract Research Center (FCRC) to support the SDI program. FCRC's such as the Rand and Mitre Corporations have existed for many years to provide a centralized and independent mechanism for program analysis.

OMB's Office of Federal Procurement Policy has issued a directive which states that "agencies will rely, to the extent practicable, on existing in-house and contractor sources for satisfying their special research or development needs."

A. Why is it not practical to use existing in-house or contractor resources for this work?

B. Has SDIO conducted a formal survey of available FCRC and contractor capabilities regarding strategic defense?

Answer. A. An assessment of government organizations and contractor resources was conducted with the following conclusions:

The use of a government organization to provide the special technical support needs of the SDIO was found to be undesirable for two main reasons: it would be difficult to attract, retain, and manage the required number of highly qualified scientific and engineering personnel; and the needed personnel buildup could not occur sufficiently rapidly, nor respond sufficiently quickly to changing requirements.

The use of for-profit firms was found to be undesirable because of the conflicts of interest inherent in the for-profit organization approach; the probable inability to ensure total objectivity and independence of thought; and the negative business impact on such a firm through its necessary dedication to SDIO technical support alone.

B. Of the various not-for-profit alternatives examined, a new FFRDC ranked highest. The FFRDC mechanism was considered to offer quick, responsive handling of SDIO needs, while allowing considerable freedom in establishing salary structures and working environments conducive to attracting top scientific and engineering talent. While reliance on an existing FFRDC or other non-profit organization potentially would provide more readily or more quickly available capability and staff, none was found to have the breadth of specialized expertise to undertake major SDI technology program review and oversight. Any existing organization, including an existing FFRDC or national laboratory necessarily will have ongoing work, and a deeper background, in one technology or another. Nor would any organization already in existence be in a position to offer the desired degree of dedication to, and exclusive focus on, the SDI program. The establishment of a new FFRDC, specifically oriented to SDIO technical support needs, was found to be likely to result in materially greater responsiveness and support than trying to reorient an existing FFRDC.

Question. Would the work conducted by this center be competitively procured?

Answer. It is presently anticipated that SDIO will enter into a contract for an initial term of five years with the FFRDC from competing proposals. We have been contacted by several interested parties and individuals in response to the series of published announcements of the Departments' intent to establish the SDII. Those expressing interest in submitting the proposal have been advised that we will consider fully and fairly any proposals that are received.

To date, we have not received any proposals to operate the SDII. We have received one related proposal to provide interim technical support until the SDII is effectively operational; we have responded that we would consider the proposal should such a need become apparent.

Question. How many staff members would this center eventually require, and at what annual operating cost?

Answer. The number of personnel for the FFRDC is presently uncertain. The proposal that we anticipate we will receive presumably will identify the level of personnel staffing thought to be required to meet the stated function of the FFRDC. We would expect to decide the staffing and cost in subsequent negotiations and discussions.

Question. Is the establishment of this center affected by the Competition in Contracting Act of 1984? If not, explain why.

Answer. Yes. All DoD contracts are subject to the Competition in Contracting Act of 1984. This includes the SDI FFRDC.

Question. Provide estimated startup costs for this center, by year.

Answer. There is no projected budget at present for the FFRDC. We anticipate that the proposals will detail cost estimates for start up and recurring operation over the five year contract.

Question. Provide schedule milestones for the establishment of the center, up to the point when a full support capability is achieved.

Answer. We would expect to receive proposals for evaluation this summer. Hopefully, we can arrive at a decision and contract for start-up of the FFRDC by the end of fiscal year 1986. The staffing effort would occur at the same time and full support capability should be achieved during fiscal year 1987.

Question. Provide the dollar amount of FY 1985 and FY 1986 funding programmed by SDIO for existing FCRCs, by FCRC by year.

Answer. The initial source of funds for the SDII is expected to be existing appropriated funds for the SDIO. We are presently examining the programs from which the funds might be reprogrammed.

SPACE TRANSPORTATION

Question. SDI's phase I system architecture studies concluded that SDI would require the transportation of up to 200 million pounds of equipment into space. This would require up to 5,000 space shuttle launches. To be affordable, the cost per pound to lift this material into orbit must be reduced from $3,000 to around $300.

What progress has been made in this area, and what work is planned in FY 1987?

Last year, you stated that the feasibility issue of reducing launch costs to affordable rates is a key factor in SDI system development. However, SDI is only allocating $11 million, or less than one percent of its budget, to this area in FY 1986. Why is such a low rate of funding acceptable?

Is it true that SDI planners are assuming a "baseline architecture" calling for 53 million pounds of space-based equipment which would require 23 years to put in place and cost up to $174 billion for transportation alone? Do you consider this to be affordable?

According to NASA officials, over 150 payloads in the proposed SDI baseline architecture would not fit in the space shuttle.

Could these payloads be carried aboard the National Aerospace Plane?

If not, how do you rate the urgency of the National Aerospace Plane program, given the need to develop a separate vehicle for SDI?

Answer. As I stated earlier, there is currently no configuration for a heavy-lift access-to-space system using NASP technology. The 150 large payloads referenced by NASA may be able to be modularized to fit into smaller vehicles. Some of these modules, however, may also be quite large and be unsuitable for packaging into a sleak, aerodynamic launch system.

SDIO supports the NASP program as providing yet another option for access-to-space systems in the far term.

Question. When is the NASP's estimated IOC?

Answer. No IOC has been established for an operational NASP system for either Air Force or SDI-type missions.

Question. For the record, break down the 53 million pounds by year and show what portion of that could be accommodated by the NASP, given only an initial NASP capability by the year stated above and anticipated production rates.

Answer. With no configurations established for NASP, it is not possible to answer this question in a meaningful manner.

Question. Presumably, NASA will be required to reduce launch costs dramatically in order to make SDI affordable. Currently, NASA's launch operations are highly manpower-intensive, employing over 25,000 personnel.

How will DoD ensure that NASA is taking accelerated action to revolutionize the cost of launch operations consistent with SDI's timetable?

Answer. Consistent with current Directives, the DoD is charged with responsiblity for developing the next generation of unmanned heavy-lift launch systems while NASA has responsibility for developing the next generation of manned systems. Accordingly, both DoD and NASA share the responsibility to develop the technology base that will, in large part, support the development of either type system. Within DoD, the Air Force and SDIO must support the technology base if more cost efficient systems are to be available in the post-1995 timeframe.

Question. Won't this require significant increases in the automation of launch operations?

Answer. Yes. The importance of automation was discussed in an earlier answer.

Question. What R&D is being conducted in this area, by either DoD or NASA?

Answer. U.S. investments in the technology for improved, more cost efficient access-to-space systems has been severely limited since 1973. Currently, only a small number of programs with limited funding are addressing critical technology needs in the areas of propulsion, structures, automated systems, etc. requiring DoD and NASA. Last year, the National Security Council (NSC) issued a directive to identify the technology programs needed to insure U.S. pre-eminence in access-to-space systems in the post-1995 timeframe. The report in response to this directive was submitted to the NSC on 15 May 1986. The SDIO budget request supports implementation of the recommendations of this report.

NATIONAL TEST BED (NTB)

Question. The National Test Bed (NTB) is a project to demonstrate and evaluate alternative SDI architectures and battle management technologies using computer simulations. NTB is budgeted at $77 million in FY 1987, up from $18 million in FY 1986.

Schedules for this program indicate that a site for the core facility of the NTB will be selected at the same time that system requirements are being determined. Why shouldn't site selection wait until these requirements have been firmly defined?

Answer. Preliminary studies have provided facility requirements indicating that the National Test Facility building will be required to house computer facilities, test control facilities, laboratories and office space. Area requirements will be somewhere between 300,000 to 400,000 square feet. These preliminary requirements, together with other site selection criteria are sufficient to allow a sound site selection process to occur in parallel with NTB concept definition and preliminary design. The results of concept definition will be available before commencing design of the NTF.

Question. What is meant by an "interim" capability, and why is this necessary, given an IOC of ——— for the full NTB system?

Answer. "Interim" NTB capability refers to the capability of the NTB achieved prior to completion of construction for a National Test Facility and the IOC in ———. The interim capability is required to support system level validation tasks to be conducted in conjunction with other technology validation experiments, some of which will occur prior to the NTB IOC. Interim capability will be achieved by making use of an existing facility (or building) prior to construction of the NTF.

Question. Has the planning for this major test facility been coordinated with the Directors of Developmental and Operational Test and Evaluation? Will these offices review and approve SDI test planning, including Test and Evaluation Master Plans?

Answer. There has been only informal coordination at this phase of NTB activities. For example, there was participation by the Air Force Operational Test and Evaluation Center (AFOTEC) in the source selection evaluation board for NTB. Greater coordination will occur as concepts emerge and plans for development and aquisition of the NTB are put into effect.

Question. What sites are candidates for the National Test facility of the SDIO National Test Bed and when (month and year) will site selection be made? When will requirements documents be formally approved within SDIO?

Answer. The National Test Facility of the SDI National Test Bed will be located at Falcon Air Station near Colorado Springs, Colorado. A 35 percent design of this facility will be approved by SDIO this calendar year to support an FY88/89 construction project. Final design of the National Test Facility is scheduled to be completed in approximately July, 1987.

Question. Information provided to the Committee in February 1986 indicates that the NTB preliminary design contract would be awarded in January 1986. However, other information indicates that this contract will not be signed until the Summer of 1986.

A. What is the current estimate of contract award?

B. Has the program slipped? If so, explain why?

C. Does SDIO still plan to execute $18M million for NTB in FY 1986?

Answer. A. Contracts for NTB concept definition and preliminary design (to Martin Marietta, Rockwell, TRW, and Boeing) were awarded in March, 1986. Contracts for NTF facilities studies, and facilities concept design (to be awarded by the Army Corps of Engineers, Huntsville Division, to an Architecture and Engineering firm) are scheduled for June, 1986.

B. The program has not slipped significantly; however, some slippage to the award date for NTF facilities concept design may occur since the MILCON Subcommittee of the House Appropriations Committee has not yet released funding.

C. SDIO execution plans for the NTB program in FY 1986 now stand as follows:

	Millions
NTB Concept Definition	$4.0
NTB Preliminary Design	[1] 4.0
Technical and Mgt Support	2.4
Site selection and facilities planning support	.8
Facility design	[2] 2.5
Total	13.7

[1] An additional $2M will be required in FY87 to complete.

X-RAY LASER

X-RAY LASER TECHNOLOGY

Question. The X-ray laser is a directed energy weapon which would use the detonation of a nuclear explosion as its power source. SDIO plans to significantly accelerate the development of this technology beginning in FY 1986.

Is SDIO pursuing this technology largely to gain an understanding of the physics involved, in order to counter possible Soviet deployment of such a weapon?

Answer. The SDIO is pursuing nuclear research for three reasons: (1) to determine the feasibility and effectiveness of counterdefensive nuclear-driven systems that an adversary may develop for use against future U.S. surveillance and defensive systems; (2) to understand the technical feasibility and impact that such concepts might have on our offensive deterrent forces if utilized in Soviet defensive systems; and (3) to explore nuclear directed energy options as SDI possibilities if needed.

Question. How firm are our estimates of what the Soviets are doing in this area?

Answer. Intelligence data on Soviet nuclear research, while not conclusive, shows that the Soviets are working on the X-ray laser concept and that it would be irresponsible on our part to not fully assess this candidate countermeasures. Evidence for possible Soviet nuclear-pumped, directed energy weapon programs is based on open literature publications, discussions with Soviet scientists, ——— and other data. Soviet open literature on X-ray lasers indicates possible bomb-pumped experiments as early as the mid-1970s. ———.

Question. Isn't it possible that our accelerated research might simulate greater Soviet investment in X-ray laser technology, which is what we're trying to avoid in the first place?

Answer. The fact that SDIO is supporting some moderate level of effort in a nuclear weapons program does not necessarily mean that Soviet investment in X-ray laser technology will be stimulated although Soviet interest in X-ray laser technology predates SDI. The President has directed the SDI program emphasize nonnuclear defensive systems. The Soviets, who are clearly under no such contraint, are free to research and clandestinely develop such nuclear defensive or counter-defensive systems as they deem appropriate.

Question. The Department of Energy claims that the X-ray laser could be ready for engineering development in ———. However, former Secretary of Defense Harold Brown believes this could not be achieved before FY 1998. Whose estimate is more accurate, and why?

Answer. In a research program it is always difficult to project exactly when a concept could be ready for engineering development. Given funding consistent with a technology-limited program, the best judgment of the technical experts in the X-ray laser program is that a decision on whether or not to proceed with engineering development could be made in FY ———.

Question. Why is SDIO accelerating this very long-term technology at the expense of technology which is more realizable in the near term, given the Administration's plan to phase in SDI subsystem deployments over many years?

Answer. One of the most important reasons for pursuing nuclear research is to understand the technical feasibility and impact that such concepts might have on U.S. deterrent forces if utilized by the Soviets. Referred to as "threat definition," it is necessary to understand these concepts and their impact on the design of the other technologies being pursued by the SDIO. Besides our estimate of readiness for full-scale development in ——— is consistent with the planned early 1990s decision on whether to proceed.

Question. What size of nuclear device, in kilotons, is estimated to be required to power the X-ray laser? Would testing violate the 1974 Threshold Test Ban Treaty? When would such testing be required?

Answer. ———. The unratified 1974 Threshold Test Ban Treaty prohibits tests having a yield exceeding 150 kilotons. The SDI program will be conducted in a manner consistent with all U.S. legal obligations.

Question. The Lawrence Livermore Laboratory has recently determined that ———. Does this discovery forebode an extremely high unit cost if deployed?

Answer. No ——— not significant element of the unit cost.

Question. Provide specific examples of intelligence indicating recent Soviet research on X-ray lasers.

Answer. Evidence for recent Soviet research on X-ray lasers is based on open literature publications, discussions with Soviet scientists, ——— and other data. Soviet open literature on X-ray lasers indicates possible bomb-pumped experiments as early as the mid-1970s. ———.

X-RAY LASER FY 1986 "BRIDGE" FUNDING

Question. State the amount of the $62 million FY 1986 "bridge" funding requested by the President which would be allocated to the X-ray laser program, and describe what portion of those funds have a one-year availability.

Answer. Approximately ——— out of the $62 million FY 1986 "bridge" funding would be allocated to the X-ray laser program. All of the funds are two-year money.

Question. How many additional staff would be hired with these funds, and what is the estimated number of days to place all these staff on payroll after release of funding?

Answer. The estimated manpower requirements are provided in the table below:

	FY 1985	FY 1986	FY 1986 appropriation transfer	FY 1987
Nuclear Direct Energy Weapons:				
Los Alamos National Lab	210	195	55	610
Lawrence Livermore Nat'l Lab	400	425	45	725
Sandia National Lab	220	320	60	515
Total	830	940	140	1,850

Note: A number of the 140 full-time employees will be reassigned to the strategic defense research within the laboratories.

EASTPORT BATTLE MANAGEMENT STUDY

Question. The SDIO Panel on Battle Management, also known as the Eastport Study Group, issued its final report in December 1985. The report included a number of recommendations concerning SDI's approach to the development of a supporting command, control, and communication system.

Would you comment on the major findings of this report?

Answer. The SDIO has recently received the report of the Eastport Study Group, the panel from industry, government and academia that was appointed "to devise an appropriate computational/communications response to the (strategic defense battle management) problem and make recommendations for a research and technology development program to implement the response."

The essence of the report is captured by the following quote from it:

"The panel concludes that computing resources and battle management software for strategic defense systems are within the capabilities of the hardware and software technologies that could be developed within the next several years. However, the anticipated complexity of the battle management software and necessity to test, simulate, modify, and evolve the system make battle management and command, control and communication (BM/C ^{3}) the paramount strategic defense problem."

To address this issue the report offers a research strategy that emphasizes the interaction of BM/C ^{3} with system architecture. In this vein, the panel assesses that:

"Software technology is developing against inflexible limits in the complexity and reliability that can be achieved. The tradeoffs necessary to make the software task tractable are in the system architecture. As indicated in the Fletcher Report, the 'applique approach' of designing the system first and then writing the software to control is the wrong approach for SDI. System Architecture and Battle Management must be developed together."

With this perspective, a number of specific observation and recommendations are made relative to technology research in computing software, processing hardware, and in communications. The innovations and potential payoff of the recommended approaches are recognized. Where appropriate the SDIO will augment its B/C ^{3} technology research to incorporate the recommended steps, even as the SDI seeks innovation from all quarters and from all technologies.

The SDIO endorses the spirit and content of the report of the Eastport Study Group. It is found to be in harmony with the needs of the SDI program and its rapid implementation shall be pursued throughout the R&D effort.

Question. This panel stated that SDI, due to its "special characteristics", will require innovative approaches to program management, including the use of contractors to carry out management functions, special methods of contracting, and the establishment of an SDI infrastructure to "promote the creation of an SDI technical community."

A. Do you believe that existing management systems and contracting procedures are inadequate to handle SDI needs?

B. If so, how has this hampered the SDI effort thus far? Can you offer specific examples?

C. Do you believe it wise to establish an SDI "technical community" before the feasibility of SDI has been determined?

Answer. A. As a new, expansive research program the SDI has encountered some limitations, especially in the area of BM/C3, within existing management systems. Thus far we have been able to target those areas which we find inhibiting and feel we can reasonable resolve problems.

B. In some cases the requirement to follow procedures that implement the FAR has caused delays in the contracting process. We are reviewing all possible mechanism to alleviate the inadequacies of the present situation.

C. We believe it is important to establish an SDI "technical community" (including, most prominently, an FFRDC) in order to carry out the SDI mission of validating technology for strategic defense. We believe this will be necessary to provide adequate quantity and quality of technical competence to manage BM/C3 effectively; otherwise we may have difficulty providing adequate information to determine feasibility. Important functions will include establishing evaluation methodology to challenge contractors to perform at the state-of-the-art.

Question. This study emphasizes that a greater degree of independence within SDI subsystems would increase the feasibility of software development. However, would this not also raise system costs due to the tendency of semi-autonomous systems to 'double shoot" targets?

Answer. Studies are indicating that hierarchical architectures for BM/C^3 are efficient. Weapon wasting is minimized by coordinating weapon assignment within "battlegrounds" composed of sensor, weapon and BM/C^3 assets in a region. At the same time, estimates of software complexity indicate the software development task is tractable.

AIRBORNE OPTICAL ADJUNCT

Question. The Airborne Optical Adjunct (AOA) project involves research of an airborne sensor system for late midcourse and terminal phases. The system will initially be tested in a Boeing 767 aircraft.

General, SDIO plans to ultimately fly AOA sensors not on airplanes, but on long endurance, unmanned aircraft, according to budget documents.

a. Is this accurate?

b. What advantages and disadvantages would this offer compared to manned aircraft?

c. How many such aircraft would be needed, and what endurance, range, altitude, and payload weight capabilities would be required?

Answer. a. The AOA is an experimental program which has as its objective the validation of the technology necessary to acquire, track, discriminate, and hand over data on ballistic targets to ground-based radars. To accomplish these objectives, the program is developing an infrared sensor and data processing capability on a modified aircraft platform. These components will be tested at Kwajalein Missile Range (KMR). The type of platform, manned or unmanned, for an Airborne Optical System is currently being studied in Concept Definition.

b. There are advantages to both manned and unmanned aircraft. Considerable weight savings and performance gains would result if the vehicle were unmanned. The pressure hull, for example, could be lightened substantially if the cabin were not pressurized and the vehicle would possess longer endurance. Safety factors and nuclear environment requirements required to protect a pilot would be relaxed in an unmanned aircraft. If a commercial derivative aircraft were used, however, the gains would be less attractive since the aircraft has already been designed for a crew. The implications of flying unmanned aircraft during peacetime over the Continental United States are being considered.

c. The Army is studying the issue but SDI concept projections call for 10–20 aircraft (on-station) to provide CONUS terminal defense. More aircraft may be required for additional missions, e.g., late mid-course. The final inventory, deployment, and missions are still to be determined. For the AOA terminal defense concept, endurance is postulated to be greater than 12 hours at a platform altitude of at least 50,000 feet. Preliminary payload estimates are in the range of 20,000 to 30,000 lbs.

Question. What back-up technology is available should the Hughes long wave IR sensor prove infeasible?

Answer. There is no back-up technology available within the current schedule requirements of the AOA Experiment. However, IR detector technology is being developed under several programs at Hughes, Aerojet and Rockwell. Although the technology utilized for the AOA program by Hughes is challenging in some areas and state-of-the-art in others, it is realizable with the current vigilant management.

BOOST SURVEILLANCE AND TRACKING SYSTEM (BSTS)

Question. Up until recently, the Boost Surveillance Tracking System (BSTS) and the Space Surveillance Tracking System (SSTS) were conceived as separate systems to handle different surveillance missions. SDIO is reported assessing the potential to combine both of these functions into SSTS.

Would you explain the mission roles of the BSTS and SSTS systems, and what advantages might result from a combination of the boost phase functions into SSTS?

Answer. ———.

Question. How did this issue arise, and when will a decision be made?

Answer. The issue arose during the SDI architecture studies. ———.

Question. SDIO has $73 million budgeted for BSTS in FY 1986 and more than double that amount, $165 million, budgeted in FY 1987. It represents the single largest sensor-related budget item for FY 1987. Yet, the existence of BSTS as a separate satellite system has apparently not been decided.

A. Has the FY 1986 BSTS schedule slipped due to these issues? If not, why not?

B. If BSTS and SSTS were combined, what funding would be necessary for FY 1986 and FY 1987?

Answer. The schedule has not been slipped for the following reasons:

1. Based on the nature of the issue, the unknowns and the dual mission requirements of BSTS, changes to the program would have been premature.

2. The BSTS efforts consists of concept definition and technology development. These contracts were awarded in FY 1985. To slip these contracts would only prove more costly to the government by stretching out the tasks.

3. Engineering trade studies and analyses being performed in these efforts are providing answers to the very issue raised in this question.

4. A substantial portion of the work being performed under these efforts is needed work to support either boost phase sensor configuration.

5. The BSTS program has a number of decision points throughout such as demonstration /validation phase RFP release, contract

award, PDR, CDR, etc., the FSD phase and finally the production phase. At any of these points the effort can be changed.

B. Combined funding is unknown due to the vastly different nature of these efforts and the dual mission requirements of the BSTS program.

ATBM DEFENSE OF EUROPE

Question. Under Secretary of Defense Fred Ikle recently advised the Senate Armed Services Committee that a special fund should be established for "cooperative development" of an *antitactical* ballistic missile (ATBM) defense for Europe. There is reportedly some consideration of authorizing $50 million for this purpose in FY 1987.

1. Why should the U.S. provide such a large degree of "seed money" to encourage the Europeans to invest in their own defensive systems?

2. Are European governments concerned that the U.S. investment will allow us considerable influence over the design and development of a system which would ultimately be paid for out of European defense budgets?

3. Is verification technology at hand, short of on-site inspection, which would allow the determination that an ATBM system had *no* strategic defense capability?

4. If this is such a good idea, why isn't it in the President's budget?

5. Do you support this proposal enough to carry it out *within* available SDI funding for FY 1987?

6. Provide a plan which shows what work DoD would conduct in this area with $50 million of FY 1987 funding.

Answer. 1. The Department of Defense supports the proposal by Senator Quayle to provide $50 million to match Allied contributions to research and development on anti-tactical ballistic missile systems. Soviet tactical ballistic missiles pose a growing conventional, chemical and nuclear threat to U.S. and allied deterrent forces. Cooperative research and development in this area is in keeping with the very idea of the Atlantic Alliance and with the fundamental U.S. commitment to the security of our Allies in Europe and elsewhere.

2. As discussed above, U.S. and allied shared security interests and concerns provide the basic foundation for cooperative research and development in this area.

3. The United States has in place an effective compliance mechanism to assure that our efforts in ATBM are consistent with the ABM Treaty. We also have capability to monitor Soviet ATBM systems regarding their ABM capability and whether they are tested in the ABM mode. However, it is virtually impossible to prove a negative. Moreover, there is no obligation in the ABM Treaty—or any other arms control agreement—to demonstrate the absence of a prohibited capability.

4. The President's budget provided for continuation of the Army's Anti-Tactical Missile Program and for the SDI's examination of technologies and concepts for defense against short- and medium-range, as well as strategic, ballistic missiles. The $50 mil-

lion proposed by Senator Quayle would provide the opportunity for more accelerated work with our Allies to meet the near-term Soviet tactical missile threat.

5. As discussed above, work is already underway within the SDI on the tactical missile threat. The additional funds proposed by Senator Quayle, however, would enable us to support a more accelerated, cooperative ATBM effort with our allies than would otherwise be possible.

6. The $50 million would be used for jointly-funded, cooperative research and development with Allies on defenses against tactical ballistic missiles, looking toward near-term full-scale engineering development and deployment. The details of those projects would be worked out with the participating Allies.

CONTRIBUTION OF U.S. ALLIES

Question. What activities are planned in the coming year to elicit greater Allied participation?

Answer. Following the U.S. invitation in March 1985 to NATO countries, Japan, Australia, Israel and South Korea to participate in SDI research, we began a series of bilateral discussions with interested countries. Bilateral contacts have included visits and briefings in Washington and at SDI research facilities, and SDIO technical team visits to Allied countries. The purpose of such a dialogue is to identify areas of SDI research for possible participation, and to address various procedural issues. In addition, we have signed Memoranda of Understandings with the UK, FRG and Israel, designed to facilitate participation in SDI research through the competitive defense procurement process, and may complete similar agreements with other Allied governments as well. We will continue these various activities, as Allied and U.S. interest warrants, in the coming years.

Question. In hearings before this Committee last year, you stated that estimates of the budgetary impact of Allied participation could be available by mid FY 1986. What are those estimates? If they are not yet available, please explain why not, and provide a revised date.

Answer. Up to this point, approximately $18 million in contracts have been awarded to Allied participants for SDI research. It is not possible to predict what amount of SDIO appropriations will go to Allied participants in the future, since Allied SDI research involvement has been and will continue to be based on technical merit and competitiveness. The U.S. has made clear to the Allies that there can be no guaranteed level of effort. Allied participation on the basis of technical merit will help to increase the effectiveness of the SDI program, accelerate its schedule and reduce its overall cost.

ARMS CONTROL

Question. General, a recent summary of public opinion polls on SDI conducted since 1983 concluded that Americans have a great deal of faith in arms control, and they believe that SDI might make the arms race more dangerous. The value of arms control has also been emphasized by several scientists working on SDI projects, who stated strongly that SDI becomes more feasible if offensive arms are significantly reduced.

Would you agree that reduced offensive arms in the near-term would increase the prospect for a favorable decision on SDI full-scale development in the mid-1990's?

Answer. As we reduce offensive forces the need for defenses to guard against treaty and breakout becomes all the more important. I believe that the requirement for defenses will grow as we reduce offensive forces.

The United States is seeking radical reductions in offensive nuclear arms in the near-term. At the same time, we are pursuing SDI research and undertaking necessary modernization of our deterrent forces. All three are essential responses to the adverse trends in the strategic balance of the last decades. The SDI holds the promise of enabling us to move toward a safer more secure strategic order in the long term. While we hope for significant negotiated offensive forces reductions in the near-term, a decision of whether to deploy strategic defenses should not be contingent on progress in reductions.

Question. Wouldn't the value of reduced arms for SDI decrease over time, as system architectures and specific technologies are narrowed down?

Answer. Since we are in the research phase of our strategic defense work, considerable flexibility exists in the type of defenses we can ultimately pursue. Although the level and type of offensive forces sets basic requirements on the levels of strategic defense, reduced offensive forces would reflect the numbers of various defensive elements needed, not the type.

Question. Estimate the potential savings in SDI system costs under the assumption of a 50 percent reduction in offensive strategic nuclear arms.

Answer. The potential savings in SDI systems costs under the assumption of a 50 percent reduction in offensive strategic nuclear arms is a complex question. We will address this question as the program progresses and we improve our understanding of the myriad factors that determine total system costs.

COMPETITION IN CONTRACTING

Question. General, there is some concern in the Congress that SDI funding is not being utilized in full accord with the Competition in Contracting Act. GAO is studying this issue now, and apparently there have been some delays since your office does not maintain this type of data.

Can you state with confidence that SDI funding is being used in accord with the Competition in Contacting Act?

Answer. SDIO has implemented the competition in Contracting Act by taking the following actions:

A. Designated a competition advocate.

B. Established an internal competitive contract award goal of 50 percent.

C. Review all purchase requests and Military Interdepartmental Purchase Requests (MIPRs) to assure the maximum competition. (Contracting goals for executing agencies in the Military departments and Defense Agencies are established by the respective agency heads.)

D. Assure better descriptions and more timely notices for Commerce Business Daily Announcements.

E. Increase emphasis on competition at the subcontract level.

F. Contract's Directorate continually educates SDIO program managers on the importance of competition and, when appropriate, the justification for other than full and open competition.

[CLERK'S NOTE.—The SDIO was asked to respond more directly to the question, but the response has not been received in time to be printed in this hearing volume.]

Question. Is it true that SDIO allows its executing agents to maintain the data which verifies conformity to this law, without reporting to your office?

Answer. In September 1985, SDIO implemented a contract management information system to provide contract data for FY 1985 to date. The contract data for the system is provided monthly from each of the military services and the Defense Agencies executing the SDI program.

Question. Do you believe that SDIO should have this data in order to have adequate top level review and control of how these funds are used?

Answer. The contract information system was implemented to allow SDIO to monitor various aspects of our agent's execution of that portion of our program for which they are responsible.

In addition to the above management system that is essential for controlling SDIO funds, SDIO has retained control of Source Selection Authority for SDIO funded programs. Delegations of source selection authority has been made to the Military Departments and Defense Agencies where contractual costs is estimated at less than $5 million. The source selection authority of SDIO funded programs/acquisitions whose total contractual cost is estimated at $5 million or more is reviewed on a case by case basis by the Director, SDIO.

Question. Last year, you stated that "our field representatives have not allowed the contracting process to drive them, but instead have pushed the system to produce faster." Competition in contracting usually takes much more time to administer than does sole source contracting; however, the costs savings from competition usually justify the extra administrative burden. In what ways does SDI "not allow the contracting process to drive it?"

Answer. Many of the problems associated with defense acquisition are a result of the complexity of the system coupled with the management layering from the program manager to the decision maker. To allow for faster processing of acquisition requests, and by adhering to regulatory requirements and DoD policy, the program manager has clear responsiblity for his program and ready access to the Director, SDIO. This permits the program staff to spend their time managing the program and not allowing the contracting process to drive them.

Question. What percentage of SDI contract dollars were competitively awarded in FY 1985 and FY 1986, and what is planned for FY 1987?

Answer.

Fiscal year:	Percent competitive
1985	69.8
1986 (Apr. 30 estimate)	72.0
1987 (planned)	65.0

PROVIDING SDI INFORMATION TO THE SOVIETS

Question. General, SDI is an unusual venture in that it is the Administration's explicit desire to eventually transfer this highly classified technology to the Soviet Union. This issue is of great concern to the Congress. At the same time, we have read where classified information on SDI has been provided to the Soviets but is still secret in the United States. Have Soviet officials, to your knowledge, received any classified information on SDI from U.S. officials? If so, why?

Answer. No, to my knowledge Soviet officials have not been given any classified information of the SDI from U.S. officials.

Question. General, a few weeks ago one of your assistants was reported to have stated the following: "In some cases, it is useful for the U.S. to tell the Soviets what we know about them and it is not useful to have the debate publicly on how we get that information (in the U.S.)." Do you agree with that statement?

Answer. Strategies employed at the Geneva negotiations are out of my purview to comment. However, there is no question but that intelligence sources and methods must be protected for national security.

DISINFORMATION

Question. A few weeks ago, a defense industry journal reported that the CIA and DoD have initiated a disinformation campaign on SDI in order to confuse the Soviets. This reportedly includes the deliberate use of false information in Congressional hearings. Is there any truth to this charge, and if so, why?

Answer. No! Neither I nor any member of my staff has ever knowingly engaged in or consented to the dissemination of false information to the Congress of American public. When the SDIO was founded we made an organizational commitment to present the Congress and American public with a forthright assessment of the present strategic situation and the ability of the SDI program to affect a positive return to stability. We have kept our program open to close public scrutiny at home and abroad. I assure you it is not the policy of the Department of Defense to withhold information from the American people.

SPACE-BASED LASERS

PROJECT FUNDING

Question. SDIO has severely reduced funding for its space-based laser (SBL) technologies in FY 1986, placing a priority instead on ground-based free electron laser and the neutral particle beam technologies.

Provide a funding profile for SBL for fical years 1985–1988, by sub-project (e.g. MIRACL, Alpha, excimer).

Answer. Space-based lasers are one of four basic concepts identified as promising approaches to the needs of a multi-layer defense. Work being pursued in a variety of technology areas such as optics, bean control, acquisition, tracking, and pointing (ATP) and fire control, atmospheric compensation, mirror technology, etc. This work directly supports our efforts to determine whether technology can support the SBL performance levels needed in various defense architectures. These technology base activities support all four concepts by seeking to satisfy a composite of technology needs in such areas as optics and pointing. A total of $397 million FY 1987 is budgeted for this technology base development. It would be difficult to say precisely what part of this technology development is SBL, what part GBL, etc. For example, the goals of a specific technology program may be driven by the GBL concept but meet the SBL needs in the process.

The only clearly identifiable SBL "sub-project" is the Alpha program. The Alpha program is currently the principal thrust of the SBL program, and its funding profile for fiscal years 1985–1988 is as follows: for FY 1985, $41 million; for FY 1986, $45 million; for FY 1987, $45 million; and for FY 1988 when the basic demonstrations are nearing completion, $20 million.

ALPHA LASER

Question. Explain what value the Alpha laser technology has for SDI, given SDIO's FY 1985 decision to push alternate technologies for this mission role. How does SDIO envision the use of the Alpha laser?

Answer. Space-based laser concepts remain an important alternative for such key roles as boost phase intercept and interactive discrimination of decoys in midcourse. Alpha is an important demonstration of scalability to high power levels needed for the HF space-based chemical laser concept.

The 2.7 micron space-based chemical laser remains at or near the top in ranking by the SDIO Systems Architects or the directed energy weapon (DEW) boost phase role against responsive threats. The Alpha laser represents an option whose wavelength and basing issues are better understood than any other DEW technology. In the near term, (FY 1986–88), the program will continue with the fabrication phase followed by a concise test series conducted to demonstrate technical feasibility in a full-scale ground test environment. At the conclusion of the test phase, a decision will be made concerning the readiness of this technology. Several plans exist, however, that include Alpha as an integral part for further maturation of the space-based laser technology.

Question. Will the deceleration of this research, coupled with accelerated consideration of system architecture and battle management issues, put SBL's on a "slow track" unable to be effectively considered in an initial SDI architecture?

Answer. No. The space-based laser based on HF/DF chemical laser and associated optics, beam control and pointing technology is some of the most mature directed energy technology and has maintained its vitality through new discoveries. We will verify scaling to high powers and large optics over the next two years. Key efforts then will be those proving that the coupled lasers/phased array telescopes will permit us to use the proven laser and beam control technology to achieve the very high brightness lasers needed for highly capable defenses.

Question. The Alpha laser is being performed under a contract valued at $200 million with potential follow-on value of several times that amount. Some have claimed that the project is being continued because this contract is too far along to terminate economically.

Was this a factor in development of the FY 1987 budget for this program?

Answer. No. Consideration of termination liabilities was not a factor in developing the FY 1987 budget for Alpha.

What termination liability would be incurred if the Alpha program were to be cancelled?

Answer. Current termination liability that would be incurred if the Alpha program were to be cancelled totals $9.4 million. The Alpha program is under contract by the Air Force to TRW, Redondo Beach, CA. This contract is valued at approximately $150 million, including fee. Earlier design contracts for the Alpha laser totaled approximately $50 million. The current TRW contract is for the fabrication and testing phases of the program. It began in October 1983 and will continue through July 1988. Alpha is a hardware-oriented program with heavy subcontractor involvement. As such, termination liabilities are high until the fabrication phase is finished and subcontractor involvement diminishes. If terminated, funds would be made available to cover this liability. There are, however, no plans to terminate Alpha. The overall contract is approximately 70% complete in terms of actual expenditures. There is absolutely no technical or mission-derived reason for termination. SDIO fully intends to carry this program to its logical conclusion.

[CLERK'S NOTE.—End of questions submitted for the record.]

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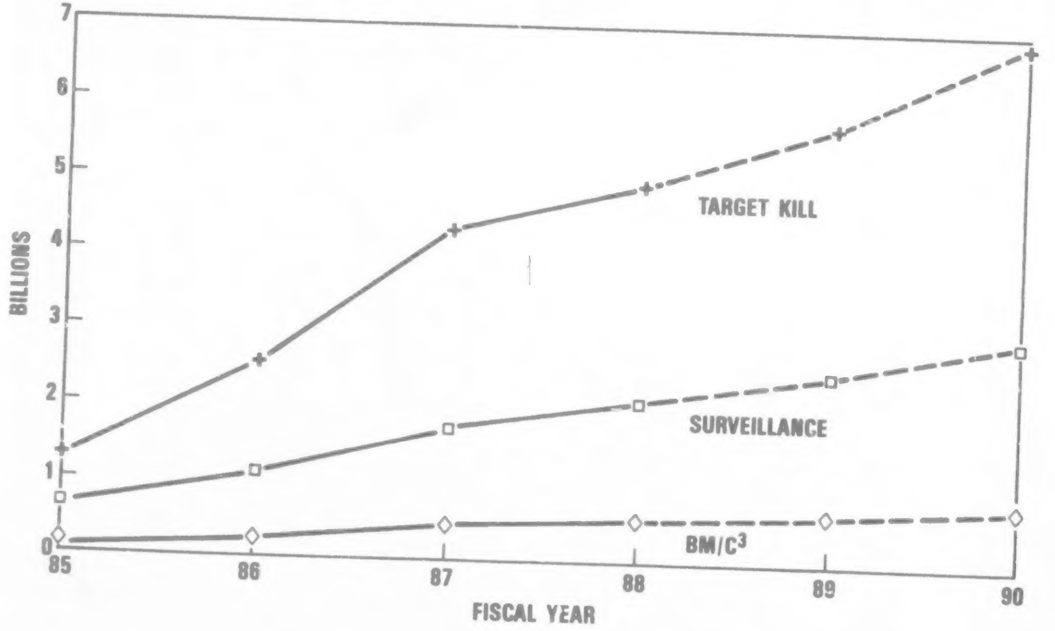

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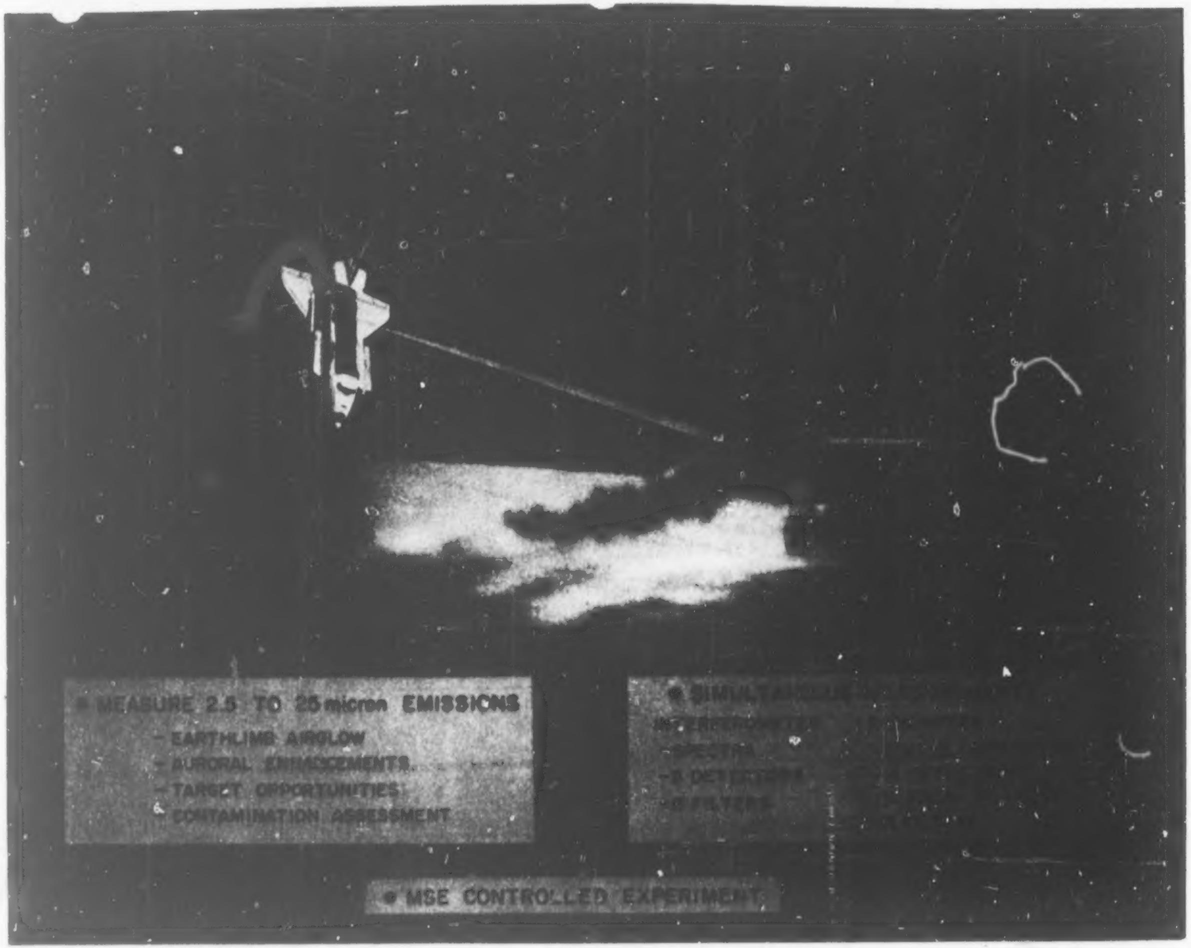

- MEASURE 2.5 TO 25 micron EMISSIONS
  - EARTHLIMB AIRGLOW
  - AURORAL ENHANCEMENTS
  - TARGET OPPORTUNITIES
  - CONTAMINATION ASSESSMENT

- SIMULTANEOUS [illegible]

INTERFEROMETER [illegible]

  - SPECTRA
  - 8 DETECTORS
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- MSE CONTROLLED EXPERIMENT

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